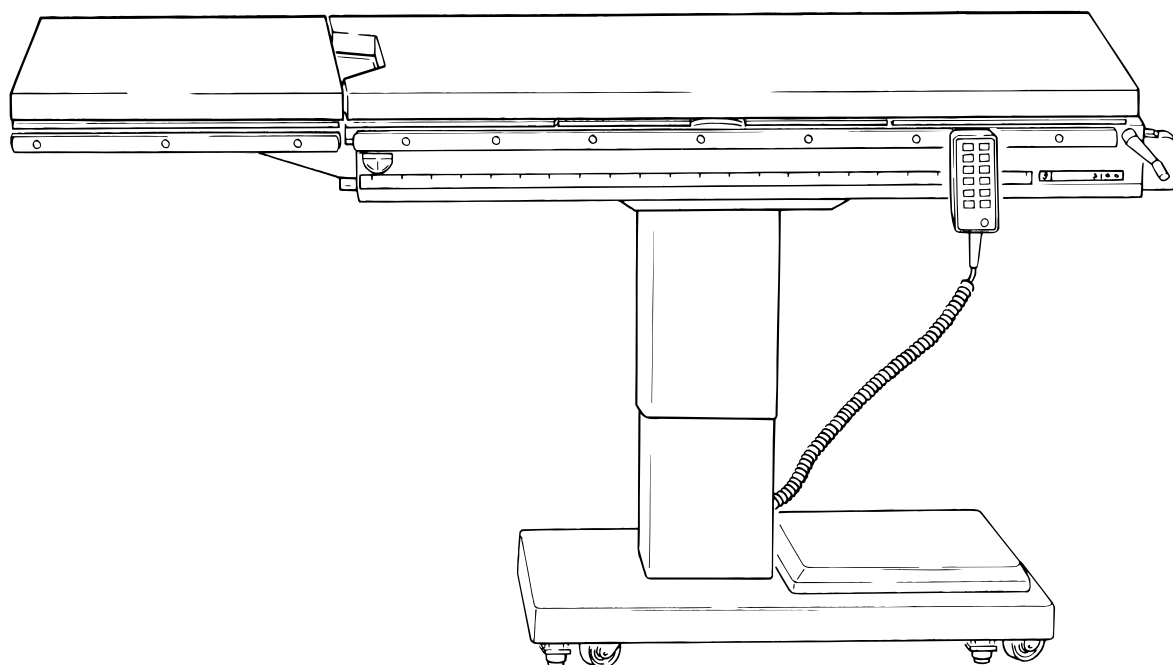




***ELITE SERIES SURGICAL TABLES***  
***MAINTENANCE MANUAL***



***MODEL 3100***

# TABLE OF CONTENTS

SECTION I HYDRAULIC SYSTEM .....	1
1-1. General .....	1
Electro-Hydraulic System .....	1
1-2. Component Operation .....	3
a. Motor/Pump Operation .....	3
b. Pressure Relief Valve .....	3
c. Mini-Valves .....	4
d. Mini-Valve in Neutral Position .....	4
e. Mini-Valve Right Port Activated .....	5
f. Mini-Valve Left Port Activated .....	5
g. Hydraulic Cylinders (Slave Cylinders) .....	6
h. Elevation Cylinder Return Circuit .....	8
i. Brake System .....	8
j. Emergency Brake Release .....	9
1-3. Hydraulic Adjustments .....	9
a. Fluid Level .....	9
b. Bleeding The Hydraulic System .....	9
c. Pressure Relief Valve .....	10
d. Speed Adjustments .....	10
SECTION II MECHANICAL TABLE ADJUSTMENTS .....	12
2-1. Kidney Lift Cylinder Adjustment .....	12
a. Side Frame Cover Removal .....	12
b. Adjustment .....	12
2-2. Slide Function Bearing Adjustment .....	12
2-3. Cassette Tray Chain Adjustment .....	12
2-4. Elevation Column Adjustment .....	13
SECTION III HYDRAULIC TROUBLESHOOTING .....	14
3-1. Precautions .....	14
3-2. Troubleshooting Notes .....	14
3-3. Elevation Diagnosis Chart .....	15
3-4. Trendelenburg Diagnosis Chart .....	16
3-5. Lateral-Tilt Diagnosis Chart .....	17
3-6. Kidney Lift Diagnosis Chart .....	18
3-7. Slide Function Diagnosis Chart .....	19
3-8. Double Action Brake Circuit Diagnosis Chart .....	20
3-9. Single Action Brake Circuit Diagnosis Chart .....	21
3-10. Flexible Hose Identification and Placement .....	22
SECTION IV ELECTRICAL SYSTEM .....	23
4-1. General .....	23
4-2. Components .....	23
4-3. Model Coverage .....	23

REV 10/01

Although current at the time of publication, SKYTRON's policy of continuous development makes this manual subject to change without notice.

# TABLE OF CONTENTS (CONTINUED)

SECTION V ELECTRICAL SYSTEM TROUBLESHOOTING .....	24
5-1. Troubleshooting Notes .....	24
5-2. Main Switch .....	24
5-3. Relay Box .....	26
5-4. Pendant Control .....	29
5-5. Solenoids .....	30
5-6. Motor/Pump Assembly .....	32
5-7. Return-to-Level Micro-Switches .....	34
WIRING DIAGRAM, MODEL 3100 (early base design) .....	36
SECTION VI 3100N ELECTRICAL SYSTEM TROUBLESHOOTING .....	38
6-1. Troubleshooting Notes .....	38
6-2. Main Switch .....	38
6-3. Pendant Control .....	39
6-4. Relay Box .....	40
6-5. Solenoids .....	42
6-6. Motor/Pump Assembly .....	44
6-7. Return-to-Level Micro-Switches .....	46
WIRING DIAGRAM, MODEL 3100N .....	48

## SECTION I HYDRAULIC SYSTEM

### 1-1. General

#### Electro-Hydraulic System

The hydraulic system (with the exception of the hydraulic cylinders and hoses) is contained within the base of the table. The hydraulic valves and pump are electrically controlled by the use of a hand-held push button pendant control. The power requirements for the table are 120 VAC, 5 amp, 60 Hz.

The table contains the following components. Refer to the block diagrams (figures 1-1 & 1-2) for relationship.

#### NOTE

Continuing development of the Model 3100 Table has resulted in several changes. However, the basic operation of the internal components remains the same. Figure 1-1 depicts the hydraulic system of the early models and figure 1-2 depicts the later models.

a. Oil Reservoir - Main oil supply. Approximately two quarts.

b. Motor/Pump Assembly - A positive displacement gear type pump provides the necessary oil pressure and volume.

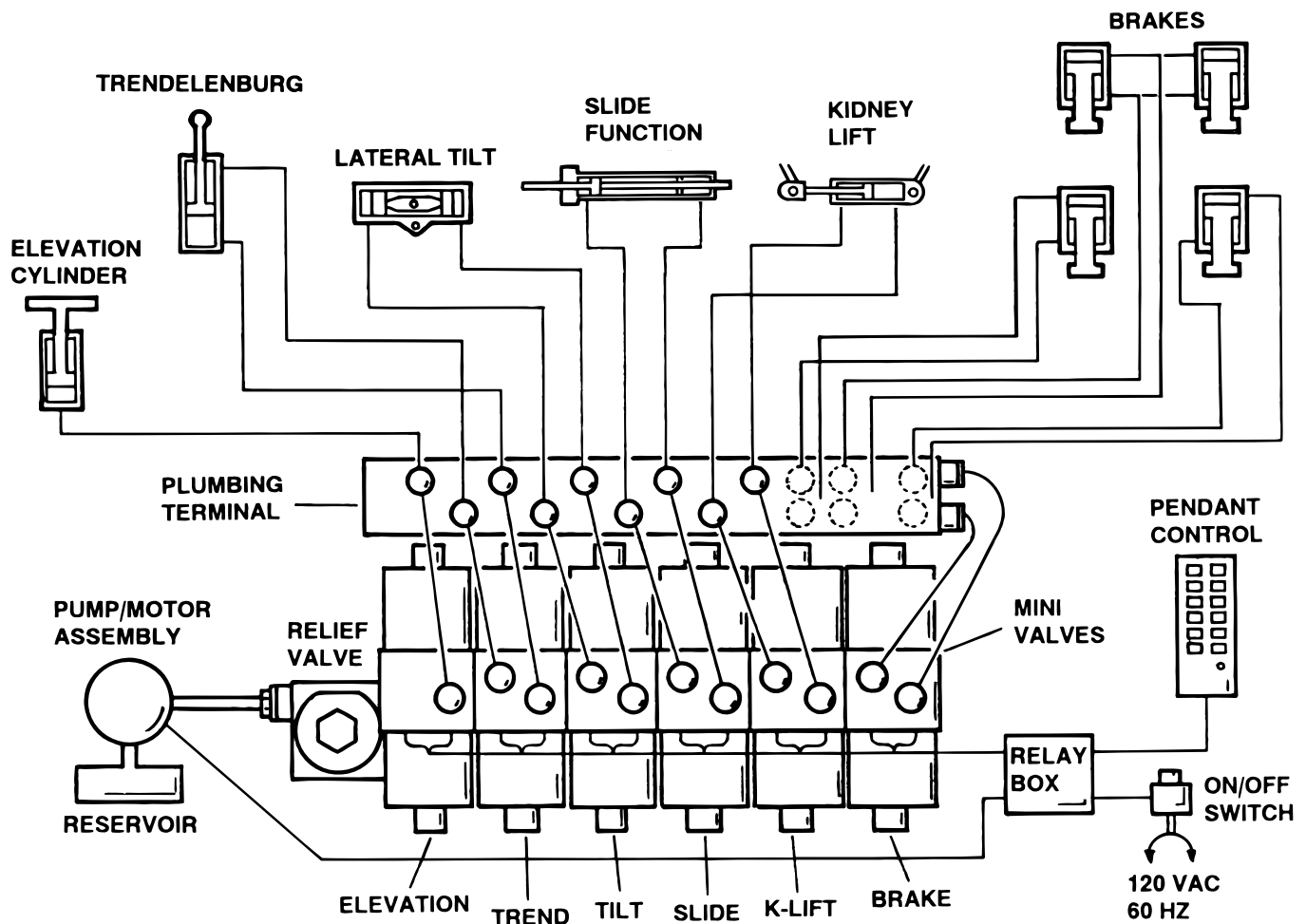


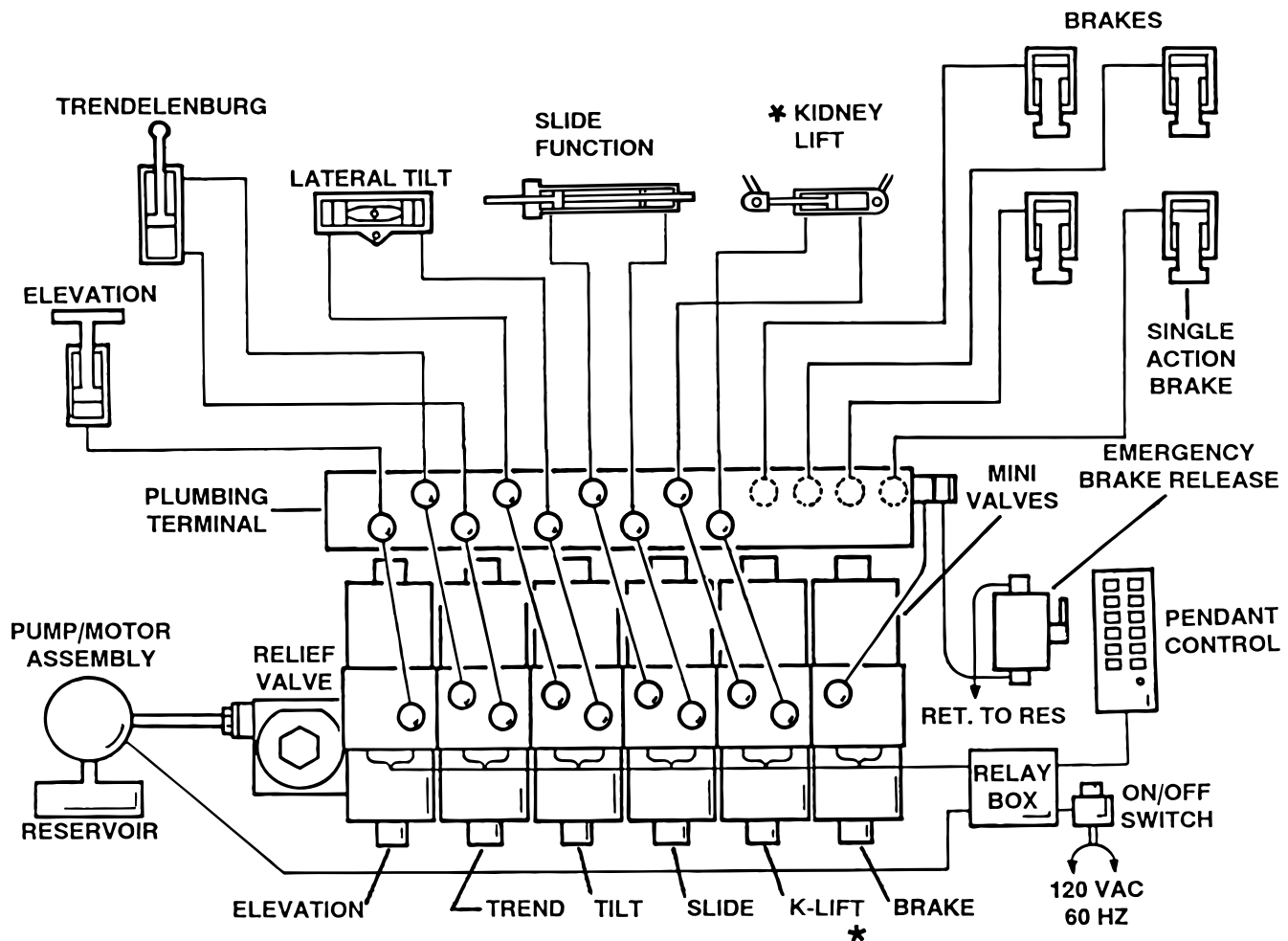
Figure 1-1. Hydraulic Block Diagram (Early Models)

c. Pressure Relief Valve - Provides an alternate oil path when the hydraulic cylinders reach the end of their stroke.

d. Electro/Hydraulic Mini-Valve Assemblies - These direct the fluid to the appropriate hydraulic cylinders.

e. Hydraulic Lines, Fittings, Connections - They provide a path for the hydraulic oil.

f. Hydraulic Cylinders - They convert the hydraulic fluid pressure and volume into mechanical motion.



\* Kidney Lift Not Applicable for Model 3100-A

Figure 1-2. Hydraulic Block Diagram (Later Models)

## 1-2. Component Operation

### a. Motor/Pump Operation

The motor/pump assembly is a gear type pump that provides the oil pressure and volume for the entire hydraulic system. The pump has an inlet side and an outlet side. The inlet side is connected to the reservoir which provides the oil supply. The reservoir has a very fine mesh screen strainer which prevents foreign material from entering the oil system.

The output line of the pump is connected to the main oil galley which is internal and common to all the hydraulic mini-valves and pressure relief valve. Also, common to the hydraulic mini-valves and pressure relief valve is an oil galley that internally connects to the oil reservoir to provide a return path for the hydraulic oil. See figure 1-3.

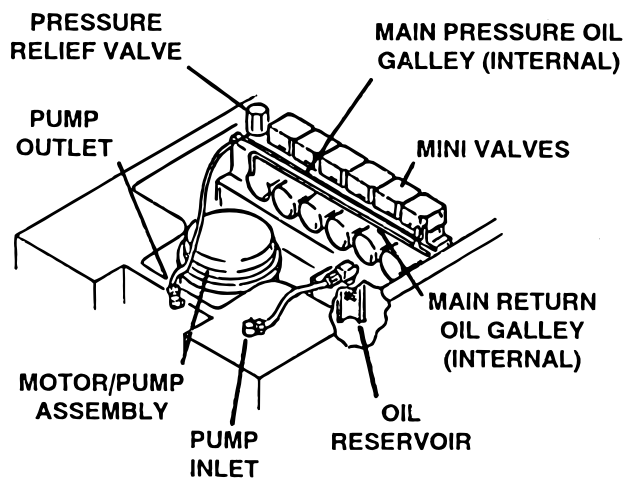


Figure 1-3.

### b. Pressure Relief Valve

This device provides an alternate oil path when the hydraulic cylinders reach the end of their stroke and the pump continues to run. If this path were not provided, the pump motor would stall because the oil cannot be compressed. The pressure relief valve is directly connected to the mini-valve bodies and shares both the common internal main pressure oil galley, and the return oil galley, that internally connect to the reservoir.

The main component of the valve is an adjustable spring loaded plunger that is pushed off from its seat by the oil pressure. The oil then flows back into the reservoir. Turning the adjustment nut

clockwise increases the amount of oil pressure re-quired to open the valve, and turning it counterclockwise decreases the amount of oil pressure. (See adjustment section for specifica-tion.)

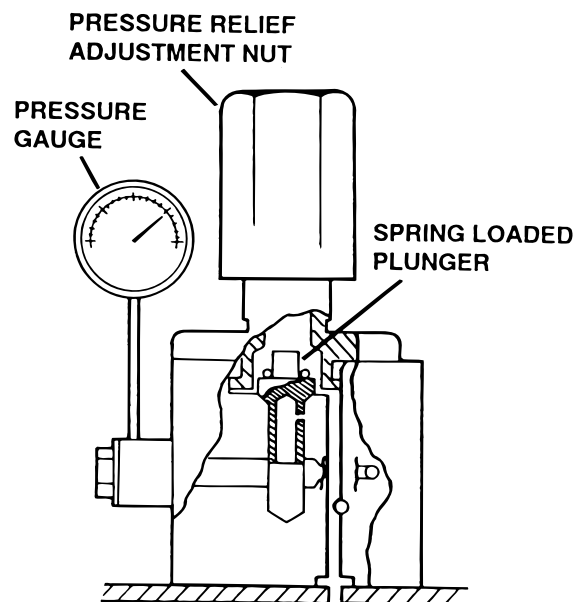


Figure 1-4. Pressure Relief Valve Not Functioning

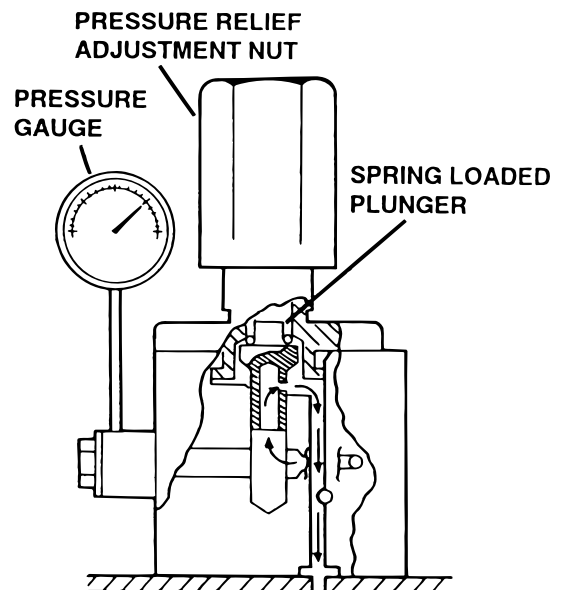


Figure 1-5. Pressure Relief Valve Functioning

### c. Mini-Valves

The operation of the mini-valves is identical for all table functions except the elevation and Single Action Brake circuits. These two hydraulic circuits use a 3-way (single check valve) type mini-valve. All other functions use a 4-way (dual check valve) type mini-valve.

Either type mini-valve is controlled by two pushing type, electrically operated solenoids. The solenoids push the spool valve (located in the lower portion of the valve) one way or the other. This motion opens the main supply galley (which has pump pressure) allowing the oil to flow through the various parts of the mini-valve to the function. The spool valve also opens an oil return circuit which allows the oil to return to the oil reservoir.

The main components of the mini-valve and their functions are listed below:

1. Spool Valve - Opens the main oil galley (pump pressure) to either mini-valve outlet depending on which direction the spool valve is pushed. Also it provides a return path for the oil returning back into the reservoir.

2. Pilot Plunger - There are two plungers in a four-way mini-valve (one in a 3-way mini-valve), one under each check valve. The purpose of the pilot plungers is to mechanically open the return check valve allowing the oil to return back into the reservoir.

3. Check Valve - Two are provided in each four-way mini-valve to seal the oil in the cylinders and oil lines and prevent any movement of the table. One check valve is provided in a 3-way mini-valve.

4. Speed Adjustments - There are two speed adjustments in each mini-valve. They are needle valve type controls which restrict the volume of oil returning back into the reservoir, thereby controlling the speed of the table surface movement. A 3-way mini-valve has only one speed adjustment.

The speed controls are always located in the return oil circuit. This prevents uncontrolled movement of the piston in the slave cylinder due to one

side of the piston being loaded with hydraulic pressure and the other side having no load.

Also, by using this control method, it doesn't matter what size cylinder and piston is used because the speed can be controlled by restricting the return oil. If the pump puts out more volume to a certain slave cylinder than the speed control is allowing to go back to the reservoir, the pressure relief valve provides an alternate path for the pump oil.

### d. Mini-valve in neutral position- (No fluid flow) See figure 1-6.

1. Spool Valve Centered - This closes off both oil pressure and oil return galleys.

2. Pilot Plungers Both Closed - The pilot plungers control the opening of the check valves. If they are closed, the check valves must be closed.

3. Check Valves - Both check valves are closed trapping the oil in the cylinder and oil lines.

4. Speed Adjustment - When the mini-valve is in the neutral position, the speed adjustment does not affect anything because there is not any oil flow.

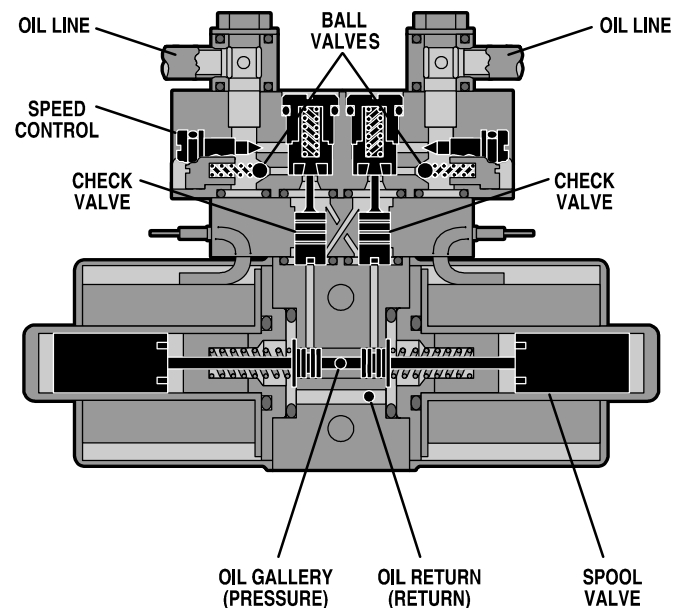
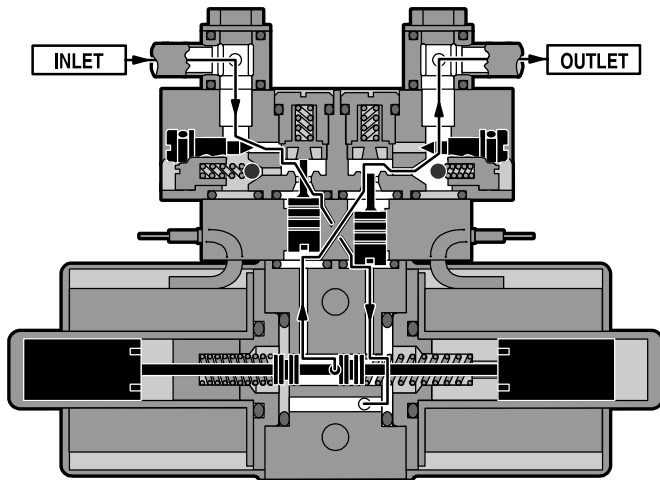


Figure 1-6. Mini-Valve in Neutral Position

### e. Mini-Valve Right Port Activated

(See figure 1-7.)

Slave Cylinder Piston Moves to Left  
Right Mini-Valve Port is Supply Line  
Left Mini-Valve Port is Return Line



**Figure 1-7. Mini-Valve Right Port Activated**

1. Spool Valve - Pushed to the left by electric solenoid. This opens the internal oil pressure galley allowing the fluid to go through the check valve and on to the cylinder. Also, the spool valve opens the oil return line providing an oil path through the internal oil galley back to the reservoir.

2. Pilot Plunger Valve - Left pilot plunger valve is pushed up by the incoming oil pressure mechanically opening the check valve located above it in the return circuit. This action allows the oil from the left side of the slave cylinder to go back into the reservoir. The right pilot plunger valve is not affected in this operation mode.

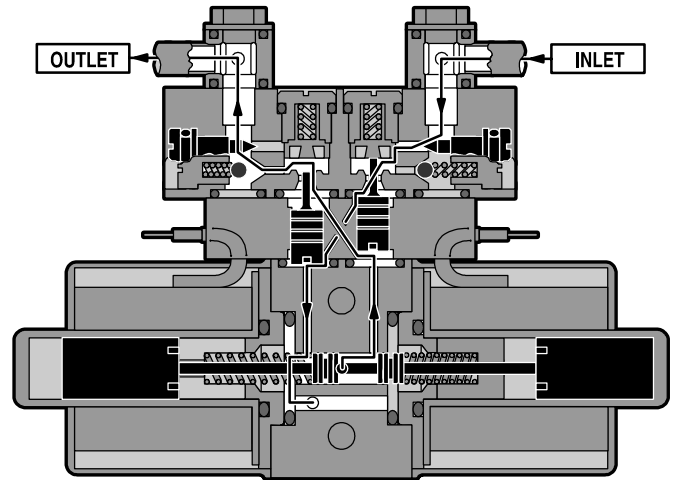
3. Check Valves - Both check valves are opened in this operation mode. The right check valve is pushed open by the oil pressure created by the pump. The oil then continues to go through the lines and pushes the slave cylinder piston to the left. At the same time, the left check valve is held open mechanically by the pilot plunger providing a return path for the oil through the mini-valve back into the reservoir.

4. Speed Adjustment - The right speed control (output side) does not have any effect in this operation mode because the oil is routed around the speed adjustment through a by-pass valve and then to the output port. The left speed adjustment controls the speed of the table function by restricting the amount of oil going back into the reservoir.

### f. Mini-Valve Left Port Activated

(See figure 1-8.)

Slave Cylinder Piston Moves to Right  
Left Mini-Valve Port is Supply Line  
Right Mini-Valve Port is Return Line



**Figure 1-8. Mini-Valve Left Port Activated**

1. Spool Valve - Pushed to the right by electric solenoid. This opens the internal oil pressure galley allowing the fluid to go through the check valve and on to the cylinder. Also, the spool valve opens the oil return line providing an oil path through the internal oil galley back to the reservoir.

2. Pilot Plunger Valve - Right pilot plunger valve is pushed up by the incoming oil pressure mechanically opening the check valve located above it in the return circuit. This action allows the oil from the right side of the slave cylinder to go back into the reservoir. The left pilot plunger valve is not affected in this operation mode.

3. Check Valves - Both check valves are opened in this operation mode. The left valve is pushed open by the oil pressure created by the pump. The oil then continues to go through the lines and pushes the slave cylinder piston to the right. At the same time, the right check valve is held open mechanically by the pilot plunger providing a return path for the oil through the mini-valve back to the reservoir.

4. Speed Adjustment - The left speed control (output side) does not have any effect in this operation mode because the oil is routed around the speed adjustment through a by-pass valve and then to the output port. The right speed adjustment controls the speed of the table function by restricting the amount of oil going back to the reservoir.



## g. Hydraulic Cylinders (Slave Cylinders)

There are several different types of hydraulic cylinders used in the table that activate the control functions. With the exception of the elevation and Single Action Brake Cylinders, all operate basically the same way. The control functions are listed below. See figure 1-9.

Reverse Trendelenburg/Trendelenburg  
Lateral Tilt  
Elevation  
Brake Cylinders  
Kidney Lift  
Slide Function

### NOTE

Kidney Lift not applicable for Model  
3100-A

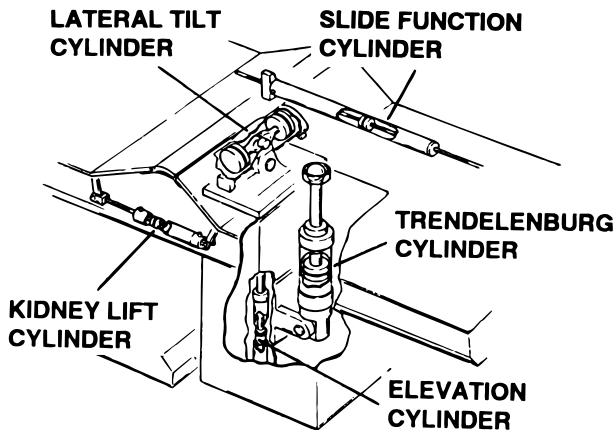


Figure 1-9. Cylinder Placement

1. Kidney Lift and Trendelenburg Cylinders - The double action cylinder is closed at one end and has a movable piston with hydraulic fluid on both sides. Connected to this piston is a ram or shaft that exits out of the other end of the cylinder. Through the use of either a ball and socket, or clevis and pin arrangement, this ram is connected to a movable table surface.

The movable surface can be moved one way or the other by pumping hydraulic fluid into either side of the piston. Obviously, if oil is pumped into one side of the cylinder, a return path must be provided for the oil on the other side. See figure 1-10.

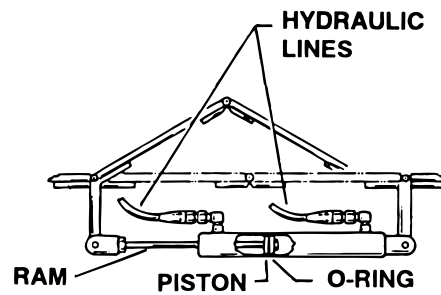


Figure 1-10. Kidney Lift Cylinder

2. Lateral Tilt Cylinder Assembly - The lateral tilt cylinder assembly consists of a dual cylinder housing with two pistons complete with connecting rods. The connecting rods are attached to a stationary pin in the housing on top of the main support column. The cylinder housing attaches to the table top via both side frames and is attached to the support column with a pivot pin. See figure 1-11.

The pistons and connecting rods are attached to a non-movable surface. Therefore, when hydraulic fluid is pumped into one side, the cylinder housing itself moves around its pivot pin causing the table top to tilt to one side. To tilt the table top in the opposite direction, hydraulic fluid is pumped into the other side of the cylinder assembly.

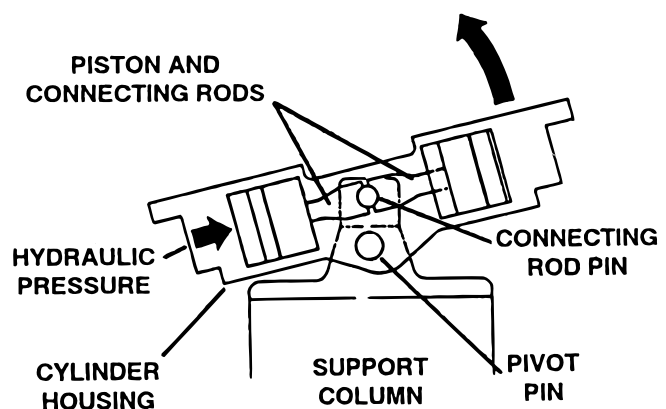
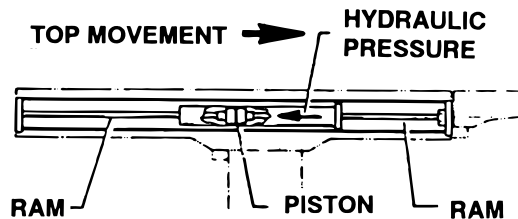


Figure 1 -11. Lateral Tilt Cylinder Assembly

3. Slide Function Cylinder - This cylinder is also a double action cylinder. It differs from the Kidney Lift and Trendelenburg cylinders in that the piston is connected to rams which exit from each end of the cylinder tube. The ends of the rams connect to each end of the table top. The cylinder tube is connected to the main side frame. When hydraulic fluid is pumped into one side of the cylinder the entire table top assembly will slide longitudinally. See figure 1-12.

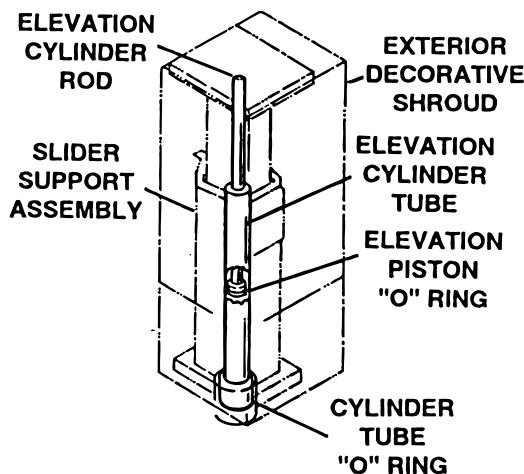


**Figure 1-12. Slide Function Cylinder**

4. Elevation Cylinder (Single Action) - This cylinder is different than the others because it does not have hydraulic fluid on both sides of the piston. It depends on the weight of the table top assembly to lower it.

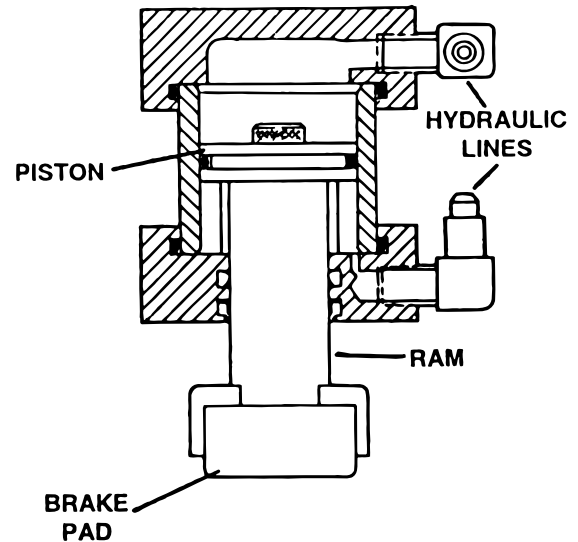
The cylinder is set in the center of the elevation main column. The piston and piston rod are elevated by the driven force of the oil pressure. When lowering, the oil that is accumulated in the cylinder is returned to the oil reservoir through the mini-valve due to the table top weight.

A slider support assembly is used to support the weight of the upper table section. The stainless steel decorative shrouds cover the flexible hydraulic hoses and slider. See figure 1-13.



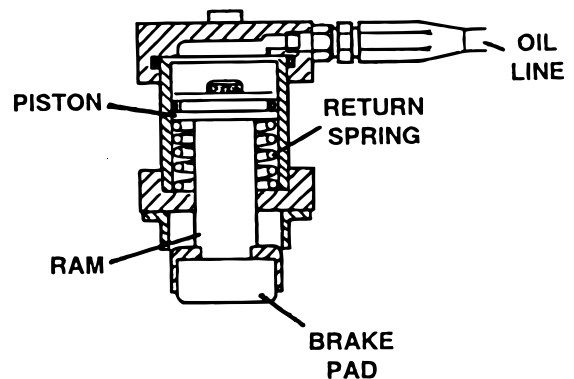
**Figure 1-13. Elevation Assembly**

5. Double Action Brake Cylinder (Early Table Models)- The brake cylinders are double action cylinders similar to the trendelenburg cylinder. The movable piston's ram is connected to a brakepad. Oil pumped into the top of the cylinder pushes the piston down and raises the table base off its casters. Oil pumped into the bottom of the cylinder pushes the piston up, lowering the base back onto its casters. See figure 1-14.



**Figure 1-14. Double Action Brake Cylinder**

6. Single Action Brake Cylinder (Later Table Models)- The brake cylinders are single action type similar to the elevation cylinder. The movable piston's ram is connected to a brake pad. See figure 1-15. Oil pumped into the top of the cylinder pushes the piston down and raises the table base off its casters. An internal return spring on the bottom of the piston, pushes the piston up to return the oil through the mini-valve to the reservoir.

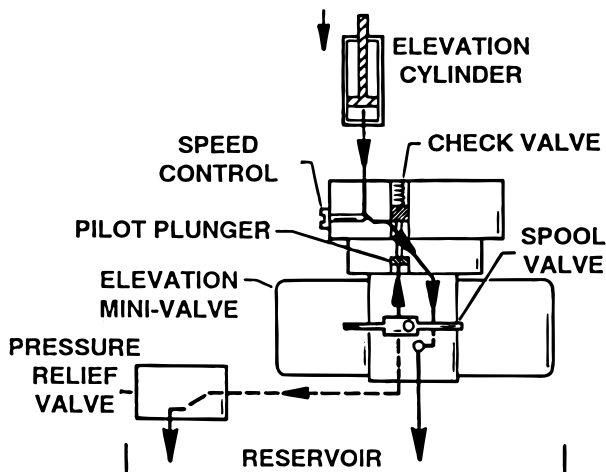


**Figure 1-15. Single Action Brake Cylinder**

## h. Elevation Cylinder Return Circuit

A three-way (single check valve type) mini-valve controls both the elevation and return circuits. The elevation circuit operation within the mini-valve is identical to the operation of the four-way valves previously described (inlet pressure opens the check valve allowing the oil to enter the cylinder). In the return position, inlet pressure pushes the pilot plunger up and opens the return check valve. See figure 1-16. The open check valve allows a path for the oil in the elevation cylinder to return to the reservoir. When the pilot plunger valve is opened, the continuing pump pressure opens the pressure relief valve which provides a return oil path to the reservoir.

The mini-valve used in the elevation circuit contains only one check valve (all four-way mini-valves use two check valves). The check valve is used to trap the oil in the elevation cylinder thereby supporting the table top. When the top is being lowered the check valve is mechanically held open by the pilot plunger through pump pressure.



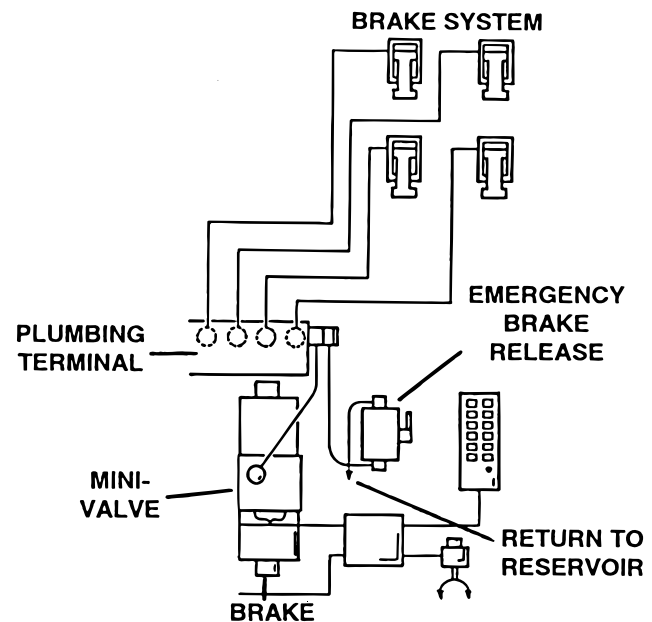
**Figure 1-16. Elevation Return Circuit**

## i. Brake System

The later model brake system consists of the following components: (figure 1-17)

1. Single action slave cylinders (4 each).

2. 3-way (single check valve type) mini-valve.
3. Manually controlled emergency brake release.
4. Plumbing terminal, flexible hose, copper lines and "O" rings.
5. Portions of the electrical system.



**Figure 1-17. Brake System Block Diagram**

Each corner of the cast-iron table base has a hydraulic brake cylinder. These single-action cylinders are hydraulically connected in parallel to the mini-valve and all four are activated together. It is normal for one corner of the table to raise before the others due to the weight distribution of the table.

On early models the brakes are activated when the "elevation-up" button on the pendant control is pushed and held down. The brakes are completely set when the elevation function (table top) starts to move upward.

Later models use an electronic timer in the relay box so that when any function on the pendant control is pushed momentarily the pump/motor and brake system mini-valve is activated and the brake cylinders are completely set. The electronic timer runs for approx. 8-10 seconds.

The brakes are released by pushing the "UNLOCK" button momentarily. An electronic timer in the relay box activates the brake function, hydraulic mini-valve and pump/motor.

When activated, the return hydraulic circuit operates similar to the elevation cylinder return circuit. Return springs inside the single-action brake cylinders retract the brake pads and provide the pressure to return the hydraulic oil back to the reservoir. The electronic timer operates the return circuit for approximately 8-10 seconds.

#### j. Emergency Brake Release

The emergency brake release is simply a manually operated bypass valve connected in parallel to the brake cylinders and the oil reservoir. See figure 1-18. When the valve is opened (turned counter-clockwise) a return circuit for the brake hydraulic fluid is opened. The return springs force the piston up pushing the hydraulic oil back into the reservoir and retracting the brake pads.

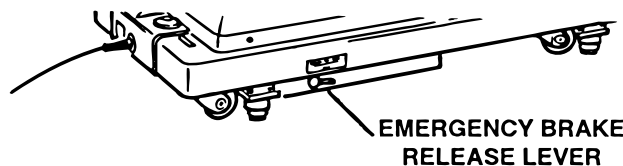


Figure 1-18.

#### IMPORTANT

The emergency brake release valve must be tightened securely when not in use.

If the emergency brake release valve has been operated, the UNLOCK button on the pendant control may have to be pressed before brakes will lock again.

If the emergency brake release valve is open or loose, two conditions could occur:

1. The brakes will release slowly- depending on how loose the valve is. This could take anywhere from a few minutes to several hours.

2. None of the table functions will operate properly- if the valve is wide open. All of the hydraulic fluid from the pump is simply pumped through the brake bypass circuit because that is the easiest path for the oil to follow.

### 1-3. Hydraulic Adjustments

#### a. Fluid Level.

The fluid level should be approximately 1/2" below the filler hole or gasket surface. If additional fluid is needed, remove the filler vent cap with a phillips screwdriver and add fluid through this opening using a funnel. See figure 1-19.

#### NOTE

The elevation cylinder should be completely down and all the other control functions in their neutral position when checking oil level.

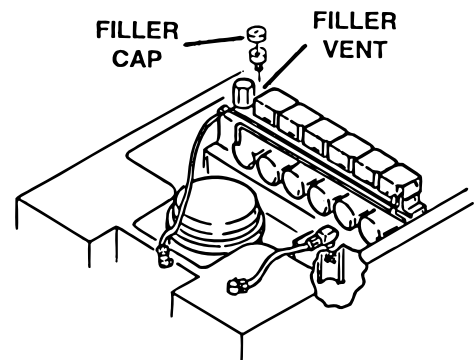


Figure 1-19.

The type of oil that should be used is Mobil DTE #25 or equivalent. This is a very high quality hydraulic oil. The table requires approximately two quarts of oil to operate properly.

#### b. Bleeding The Hydraulic System

To purge the air from the hydraulic system, operate each function back and forth at least two or three times.

#### NOTE

Whenever a hydraulic line or component is replaced, bleed the air out of the lines using the pump pressure before making the final connection. Then operate the function until it stalls in both directions.

### c. Pressure Relief Valve

The pressure relief valve is adjusted by turning the adjustment nut until the desired pressure is reached.

To adjust:

1. Remove the blind cap and attach a hydraulic pressure gauge to the main oil galley using a 6mm plumbing bolt. See figure 1-20.

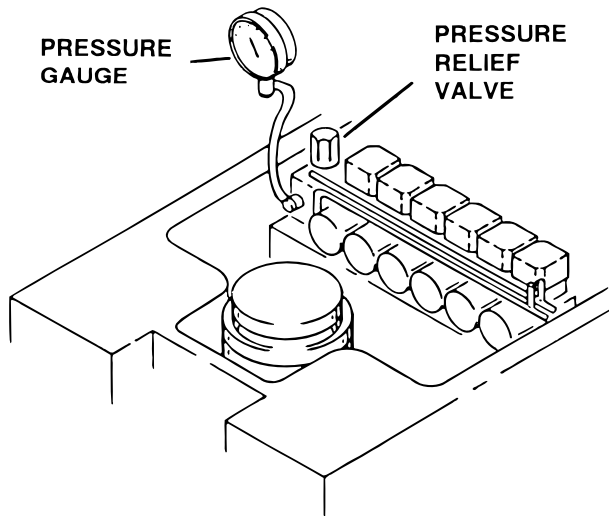


Figure 1-20.

2. Raise the table top unit until it reaches the end of its stroke and stalls. Observe reading on pressure gauge. Turn adjustment nut (clockwise to increase oil pressure, counterclockwise to decrease) until desired reading is obtained. Pressure should be 80KG/CM<sup>2</sup> -1138 PSI.

### d. Speed Adjustments

The speed adjustments control the volume of oil returning back to the reservoir thereby controlling the speed of each control function.

All four-way mini-valves, have two speed adjustments located in the ends of each valve body. All three-way mini-valves have only one speed adjustment.

One speed adjustment controls one direction of a particular function and the opposite speed adjustment controls the other direction. They are adjustable by using a small straight blade

screwdriver and turning the adjustment screw clockwise to decrease the speed and counterclockwise to increase the speed. Refer to figure 1-21.

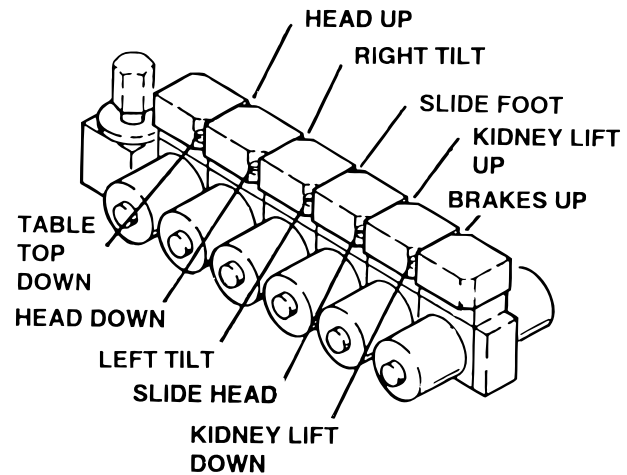


Figure 1-21.

Any control function should move in either direction at the same rate. If the rate of a certain function is too slow, open the speed control slightly and recheck. On the electric tables use the second hand on a watch and time that particular function. Match that time in the opposite direction by opening or closing the speed control.

A pressure gauge can be used to set the speed of each control function.

#### NOTE

Kidney Lift not applicable for Model 3100-A

To adjust:

1. Attach the pressure gauge onto the main oil galley pictured in figure 1-19.

2. The gauge should read the following values when operating the various control functions in either direction. Turn the speed controls until desired values are obtained.

Lateral Tilt	75KG/CM <sup>2</sup> - 1065 PSI
Kidney Lift	Up 50KG/CM <sup>2</sup> - 710PSI
	Dn 65KG/CM <sup>2</sup> - 925PSI
Trendelenburg	Hd Dn 30KG/CM <sup>2</sup> - 425PSI
	Hd Up 60KG/CM <sup>2</sup> - 850PSI
Slide	55KG/CM <sup>2</sup> - 780PSI
Brakes (Set)	10-30KG/CM <sup>2</sup> - 142-425PSI
Pressure Relief Valve	80KG/CM <sup>2</sup> - 1138PSI

Elevation - There is not a speed adjustment for raising the table. The speed control will only affect the rate of descent and it should equal the rate of elevation.

## NOTE

These pressure values should be used as a guideline. If the speed of a control function moves faster in one direction than the other direction, adjust the speed control until they are equal. You may find that the pressure gauge may record a higher reading in one direction. This is normal.



## SECTION II MECHANICAL TABLE ADJUSTMENTS

### 2-1. Kidney Lift Cylinder Adjustment (Model 3100 only)

The kidney lift is operated by two hydraulic cylinders. The table top sections which make up the kidney lift can twist and become damaged if these two cylinders do not move together properly. If an adjustment is necessary, use the following procedures.

#### a. Side Frame Cover Removal

Remove the seven phillips head bolts and side rail collars which secure the side rails, and remove the side rail. See figure 2-1. Remove the five phillips head screws from the bottom of the side panel and remove the side panel.

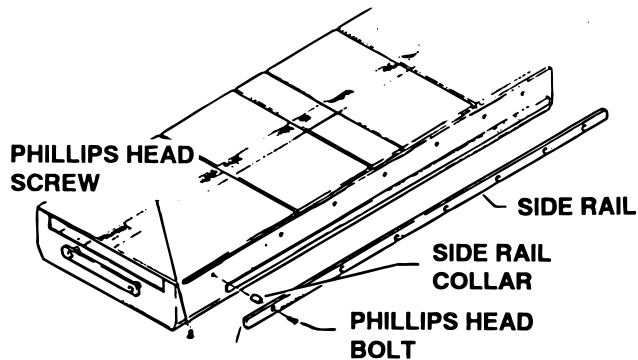


Figure 2-1. Side Cover Removal

#### b. Adjustment

Loosen the nut which locks the cylinder rod to the clevis. See figure 2-2. Adjust the cylinder travel by turning the cylinder rod until the operating length of both cylinders is equal. Tighten the lock nut.

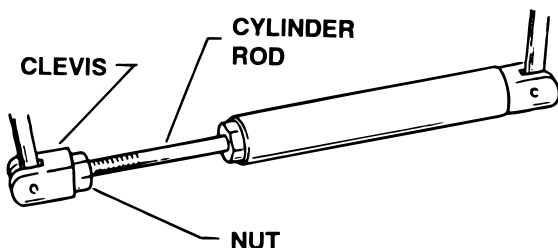


Figure 2-2. Kidney Lift Cylinder Adjustment

### CAUTION

To prevent internal O-ring seal damage, use extreme care not to damage the working surface of the cylinder rod (the portion which goes inside the cylinder when it is retracted).

When proper adjustment is complete, replace side cover and side rail.

### 2-2. Slide Function Bearing Adjustment

The bottom slide function roller bearings are mounted on eccentric shafts. To adjust the bearing fit in the side frame channel, loosen the set-screw that holds the shaft in place and turn the shaft with a screwdriver until all play is removed from side rail channel. See figure 2-3.

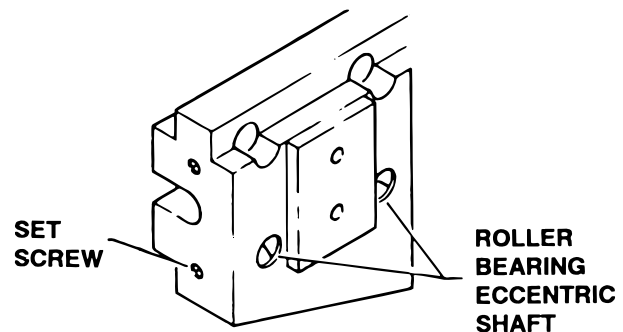


Figure 2-3. Bearing Adjustment

### 2-3. Cassette Tray Chain Adjustment

Each sprocket shaft is mounted in an eccentric bushing. See figure 2-4. To adjust the chain tension, loosen the set screw securing the bushing, turn the bushing to achieve the desired tension and retighten the set screw. To gain access to the bushing and the set screw, the side cover must be removed. See paragraph 2-1 a.

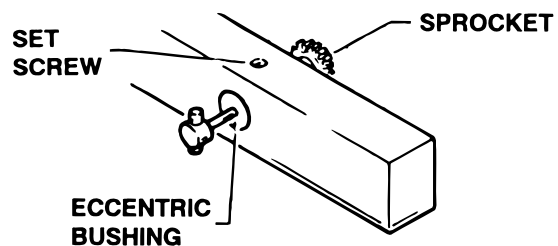


Figure 2-4. Chain Tension Adjustment

## 2-4. Elevation Column Adjustment

### NOTE

This adjustment is required only if excessive horizontal table top movement occurs, or after replacement of the elevation column bearing components. This adjustment should only be performed by a qualified technician.

### WARNING

Extreme care must be taken not to overtighten the set screws as irreversible damage to the elevation components may result.

To adjust:

1. Lower elevation column.
2. Remove the screws which retain the lower shroud to the base. See figure 2-5.
3. Using tape or bungy cord, secure the lower shroud piece to the upper shroud piece.
4. Elevate the table top until the first row of adjustment set screws becomes accessible. Gen-

tly tighten the adjustment set screws using a 4mm allen wrench until slight pressure is exerted against the bearing thrust plate.

### CAUTION

**DO NOT OVERTIGHTEN SET SCREWS.**

5. Elevate the table until the next row of adjustment set screws becomes accessible. Tighten as described in step 4 above.

6. Repeat this process until the elevation column is fully extended and all 10 rows of set screws have been adjusted.

7. Lower elevation column and repeat steps 4 through 6 until there is no horizontal movement to the table top, and the elevation column descends smoothly without binding.

### NOTE

This adjustment should be checked after one week, then approximately once a year.

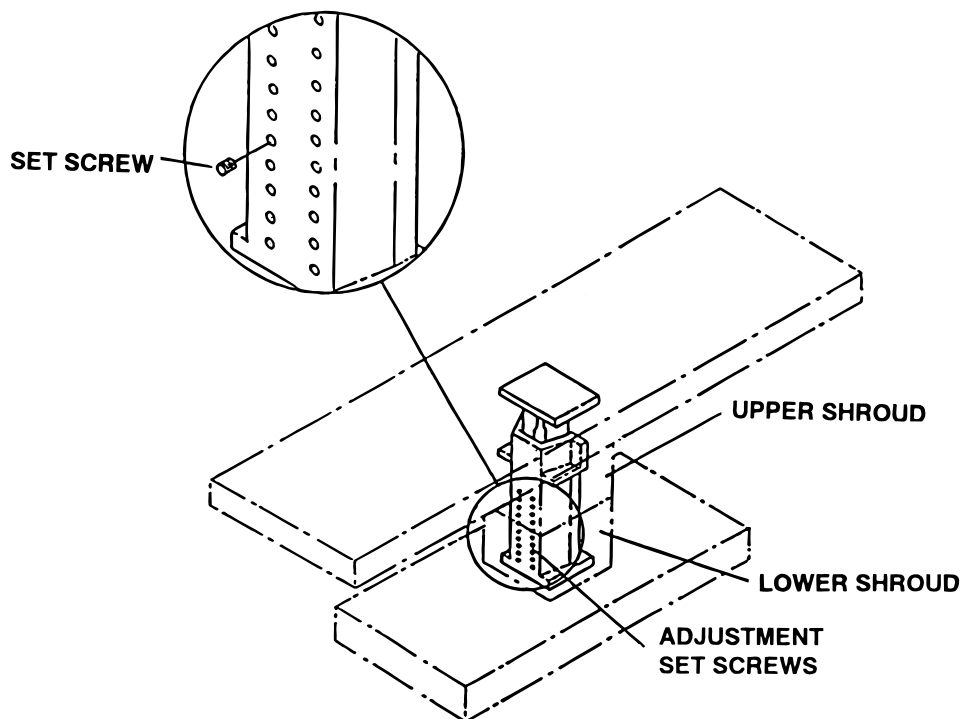


Figure 2-5. Elevation Column Adjustment



## SECTION III HYDRAULIC TROUBLESHOOTING

### 3-1. Precautions

Before attempting to troubleshoot any hydraulic problem on the table, please read through the precautions and notes below.

#### CAUTION

When disconnecting any of the hydraulic lines, fittings, joints, hoses, etc., for the following control functions, be sure these table surfaces are in their down position or completely supported.

Elevation  
Kidney Lift

When working on the trendelenburg or lateral tilt hydraulic circuits, be sure to support the table top.

#### CAUTION

Failure to follow these precautions may result in an uncontrolled oil spray and damage to the table or personal injury.

### 3-2. Troubleshooting Notes

When troubleshooting a table malfunction, first determine the following:

1. Does the problem affect all control functions?
2. Does the problem affect only one control function?
3. If the problem affects one control function is it in both directions?
4. Is the problem intermittent?
5. Is the problem no movement of a table surface or does the table surface lose position?

Once the problem has been determined, concentrate on that particular hydraulic circuit or control function.

Listed below are the hydraulic components that are common with all hydraulic circuits. If there is a problem with any of them, it could affect all control functions.

1. Motor/Pump Assembly
2. Reservoir
3. Pressure Relief Valve
4. Certain Oil Lines and Galleys

If there was a problem in the following components, only one control function would normally be affected.

1. Mini-Valve
2. Slave Cylinder
3. Oil Lines

#### NOTE

Whenever a hydraulic line or component is replaced, bleed the air out of the lines using the pump pressure before making the final connection. After all connections are tight, cycle the control function back and forth two or three times to purge the remaining air from the system.

#### IMPORTANT

When installing new "O" rings use hydraulic oil to thoroughly lubricate the "O" rings and cylinder. Keep everything clean.

Each complete oil circuit is shown on the following pages. When troubleshooting a particular function, refer to the appropriate oil circuit diagram and the list of possible problems

### 3-3. ELEVATION DIAGNOSIS CHART

#### Problem

Table will not elevate properly

#### Reason

Pressure Relief Valve Not Set Properly  
Low on Oil  
Spool Valve Not Centered  
Defective Pump  
Defective Mini-Valve  
Defective Solenoid or Wiring  
Defective Relay Box or Pendant Control

Table will not descend properly

Incorrect Speed Adjustment  
Bad Check Valve  
Spool Valve Not Centered  
Defective Solenoid or Wiring  
Defective Relay Box or Pendant Control

Table loses elevation

Bad Check Valve  
Leaking Mini-Valve  
Loose Fittings, Joints, Hoses  
Leaking "O" Ring Inside Cylinder

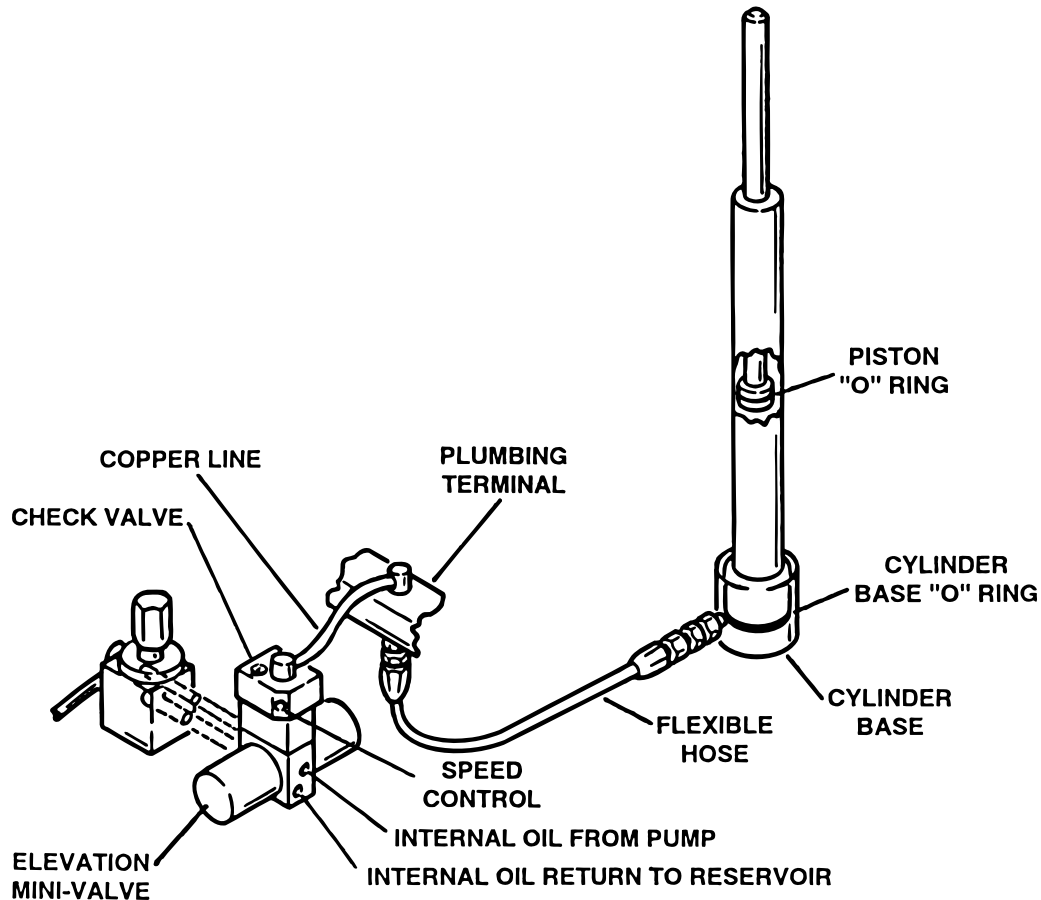


Figure 3-1. Elevation Circuit

### 3-4. TREDELENBURG DIAGNOSIS CHART

#### Problem

Trendelenburg function moves improperly

#### Reason

Incorrect Speed Adjustment  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valves  
Low on Oil  
Pinched Hose  
Defective Mini-Valve  
Pressure Relief Valve Not Set Properly  
Bad Solenoid or Wiring  
Defective Relay Box or Pendant Control

Trendelenburg function chatters or loses position

Defective or Dirty Check Valve  
Oil Leakage in Circuit  
Air Inside Cylinder  
Pinched Hose  
Low on Oil

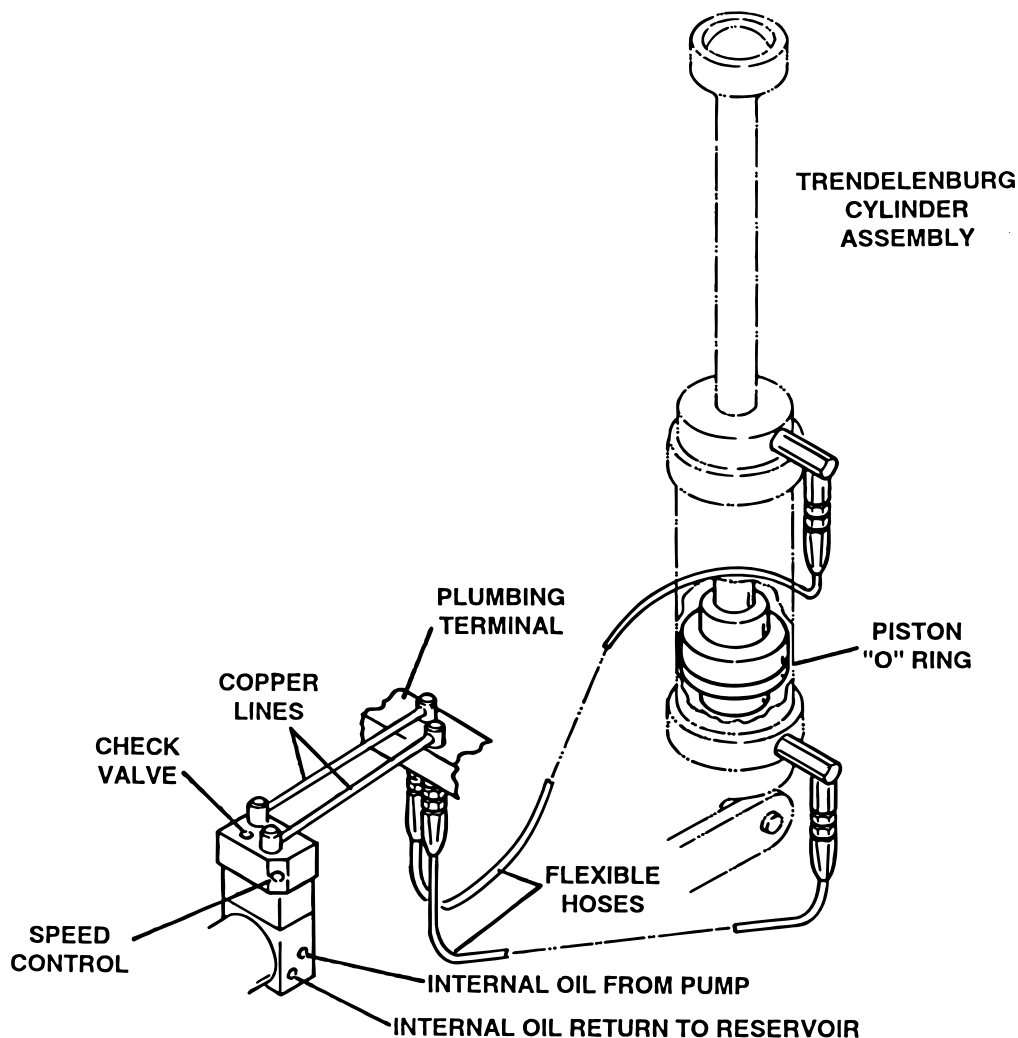


Figure 3-2. Trendelenburg Circuit

### 3-5. LATERAL - TILT DIAGNOSIS CHART

#### Problem

Lateral tilt function moves improperly

#### Reason

Incorrect Speed Adjustment  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valves  
Low on Oil  
Pinched Hose  
Defective Mini-Valve  
Pressure Relief Valve Not Set Properly  
Bad Solenoid  
Defective Relay Box or Pendant Control

Lateral tilt function chatters or loses position

Defective or Dirty Check Valves  
Oil Leakage in Circuit  
Air Inside Cylinder  
Pinched Hose  
Low on Oil

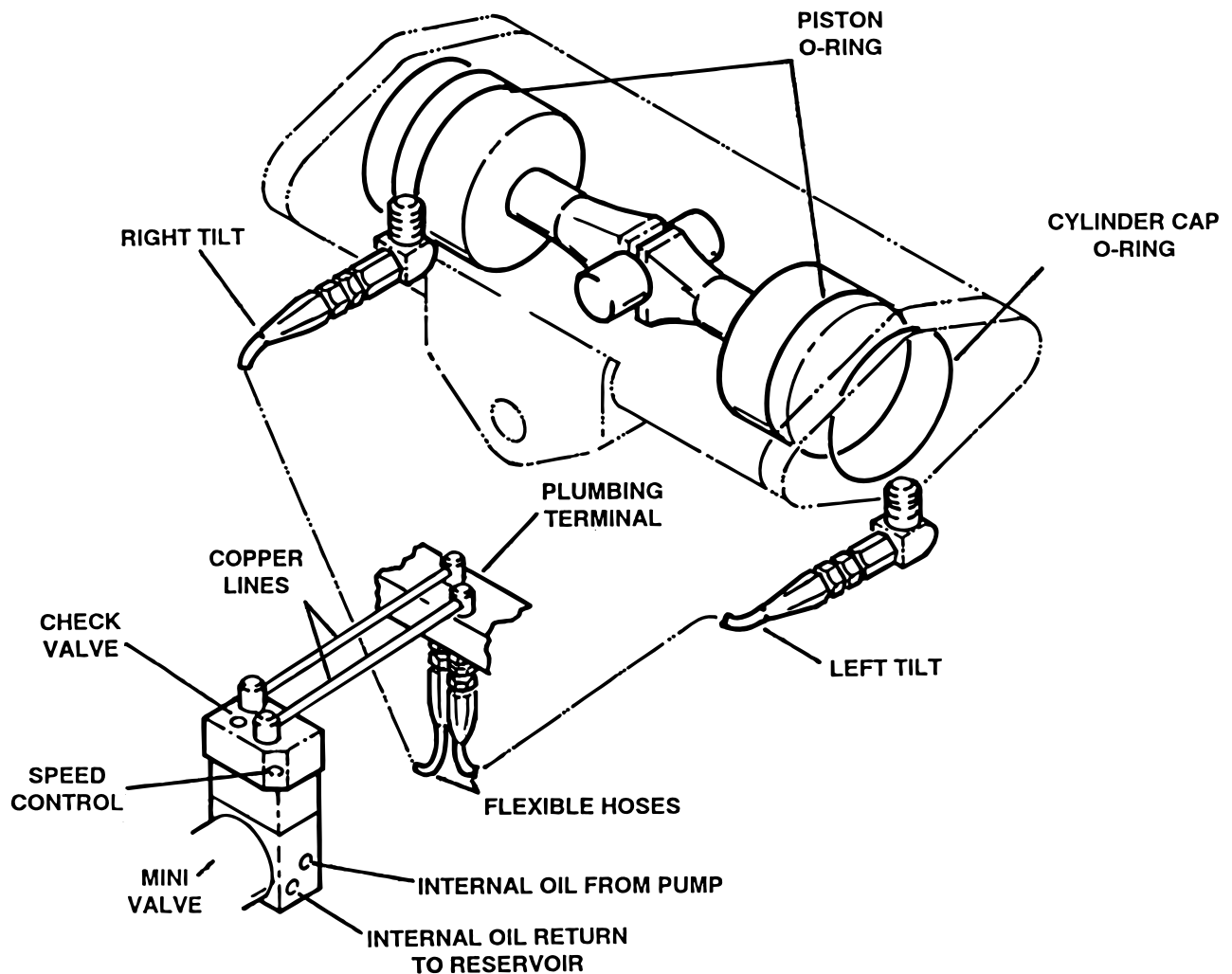


Figure 3-3. Lateral Tilt Circuit

### 3-6. KIDNEY LIFT DIAGNOSIS CHART

#### Problem

Kidney Lift moves improperly

#### Reason

Incorrect Speed Adjustment  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valve  
Low on Oil  
Pinched Hose  
Defective Mini-Valve  
Pressure Relief Valve Not Set Properly  
Bad Solenoid  
Defective Relay Box or Pendant Control

Kidney Lift chatters or loses position

Defective or Dirty Check Valve  
Oil Leakage in Circuit  
Air Inside Cylinder  
Pinched Hose  
Low on Oil

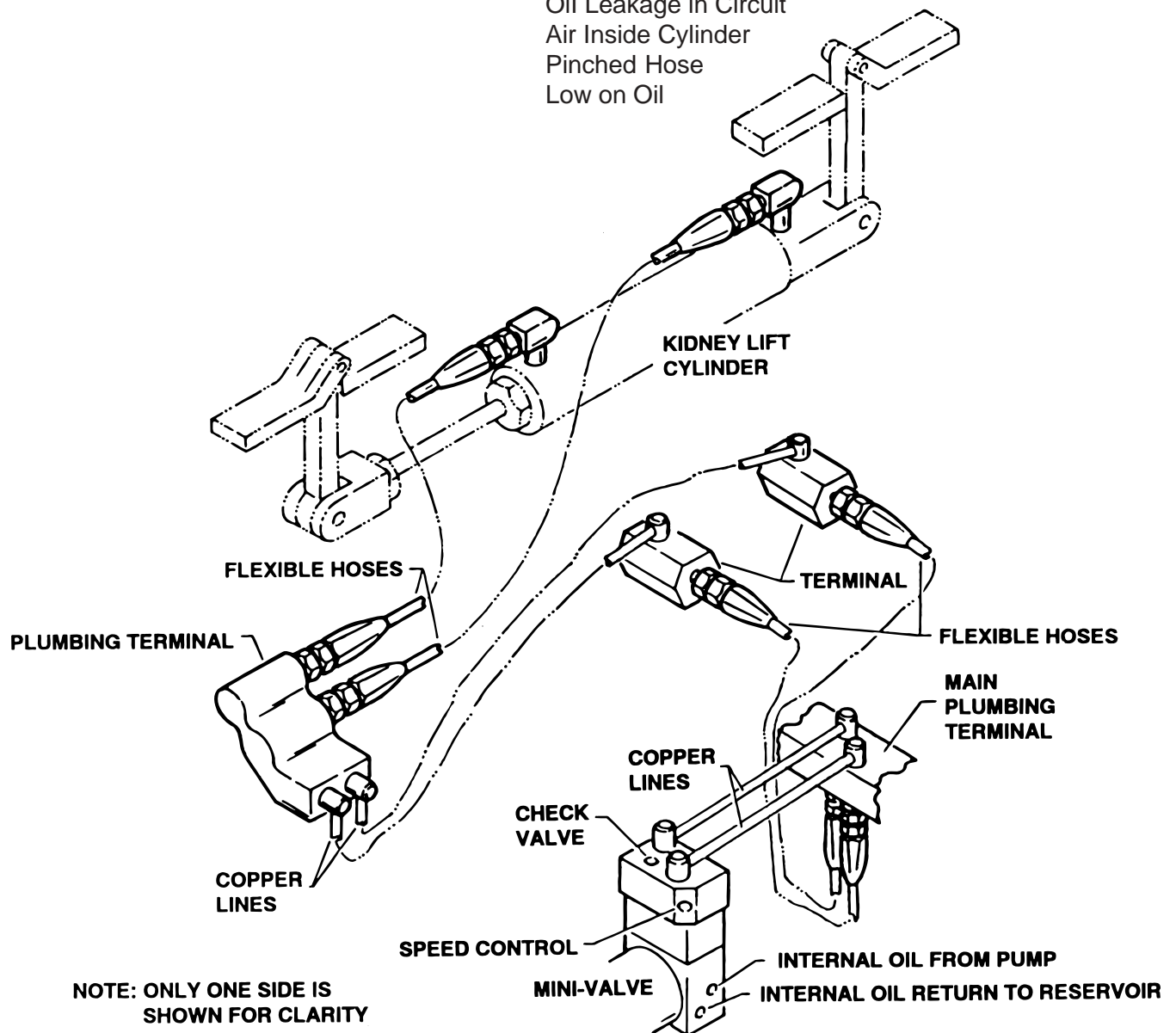


Figure 3-4. Kidney Lift Circuit (Model 3100 only)

### 3-7. SLIDE FUNCTION DIAGNOSIS CHART

**Problem**

Slide function moves improperly

**Reason**

Incorrect Speed Adjustment  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valve  
Low on Oil  
Pressure Relief Valve Not Set Properly  
Pinched Hose  
Defective Mini-Valve  
Bad Solenoid  
Defective Relay Box or Pendant Control

Slide function chatters

Defective or Dirty Check Valve  
Oil Leakage in Circuit  
Air Inside Cylinder  
Pinched Hose  
Low on Oil

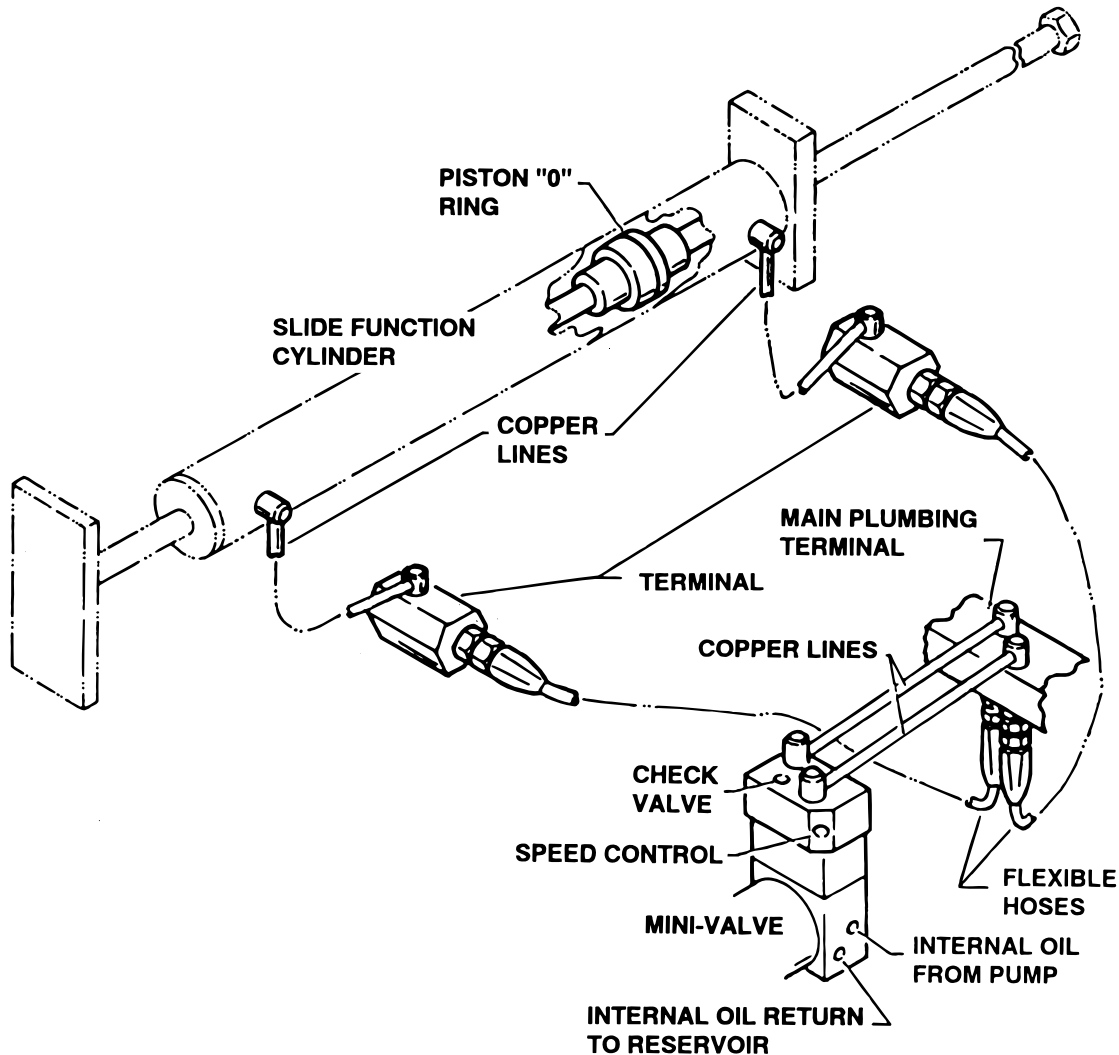


Figure 3-5. Slide Function Circuit

### 3-8. DOUBLE ACTION BRAKE CIRCUIT DIAGNOSIS CHART

#### Problem

Brakes will not set properly

#### Reason

Incorrect Speed Adjustment  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valves  
Low on Oil  
Pressure Relief Valve Not Set Properly  
Pinched Hose  
Defective Mini-Valve  
Defective Relay Box or Pendant Control

Brakes will not stay locked

Defective or Dirty Check Valves  
Oil Leakage in Circuit  
Air Inside Cylinder  
Pinched Hose  
Low on Oil

Brakes will not retract properly

Incorrect Speed Adjustment  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valves  
Low on Oil  
Pressure Relief Valve Not Set Properly  
Pinched Hose  
Defective Mini-Valve  
Defective Relay Box or Pendant Control

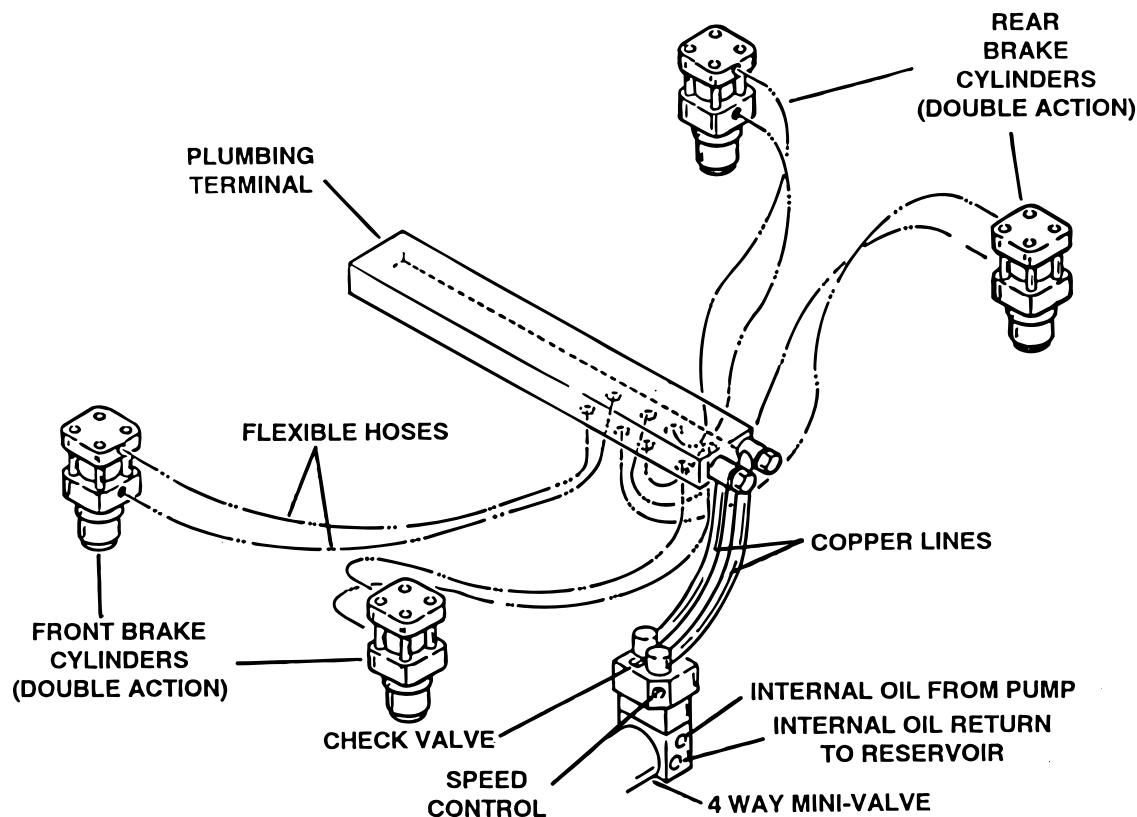


Figure 3-6. Double Action Brake Circuit

### 3-9. SINGLE ACTION BRAKE CIRCUIT DIAGNOSIS CHART

#### Problem

Brakes will not set properly

#### NOTE

If brakes have been released with the Emergency Brake Release Valve, brakes will not reset until MOVE Circuit has been activated.

#### Reason

Emergency Brake Release Valve Open or Defective  
Spool Valve Not Centered or Adjusted Properly  
Bad Check Valve  
Low on Oil  
Pressure Relief Valve Not Set Properly  
Pinched Hose  
Defective Mini-Valve  
Defective Relay Box or Pendant Control

Brakes Will Not Stay Locked

Emergency Brake Release Valve Open or Defective  
Defective or Dirty Check Valve  
Oil Leakage in Circuit  
Leaking "O" Ring Inside Cylinder

Brakes will not retract properly

Incorrect Speed Adjustment  
Bad Check Valve  
Spool Valve Not Centered  
Defective Mini-Valve  
Defective Solenoid or Wiring  
Defective Relay Box or Pendant Control

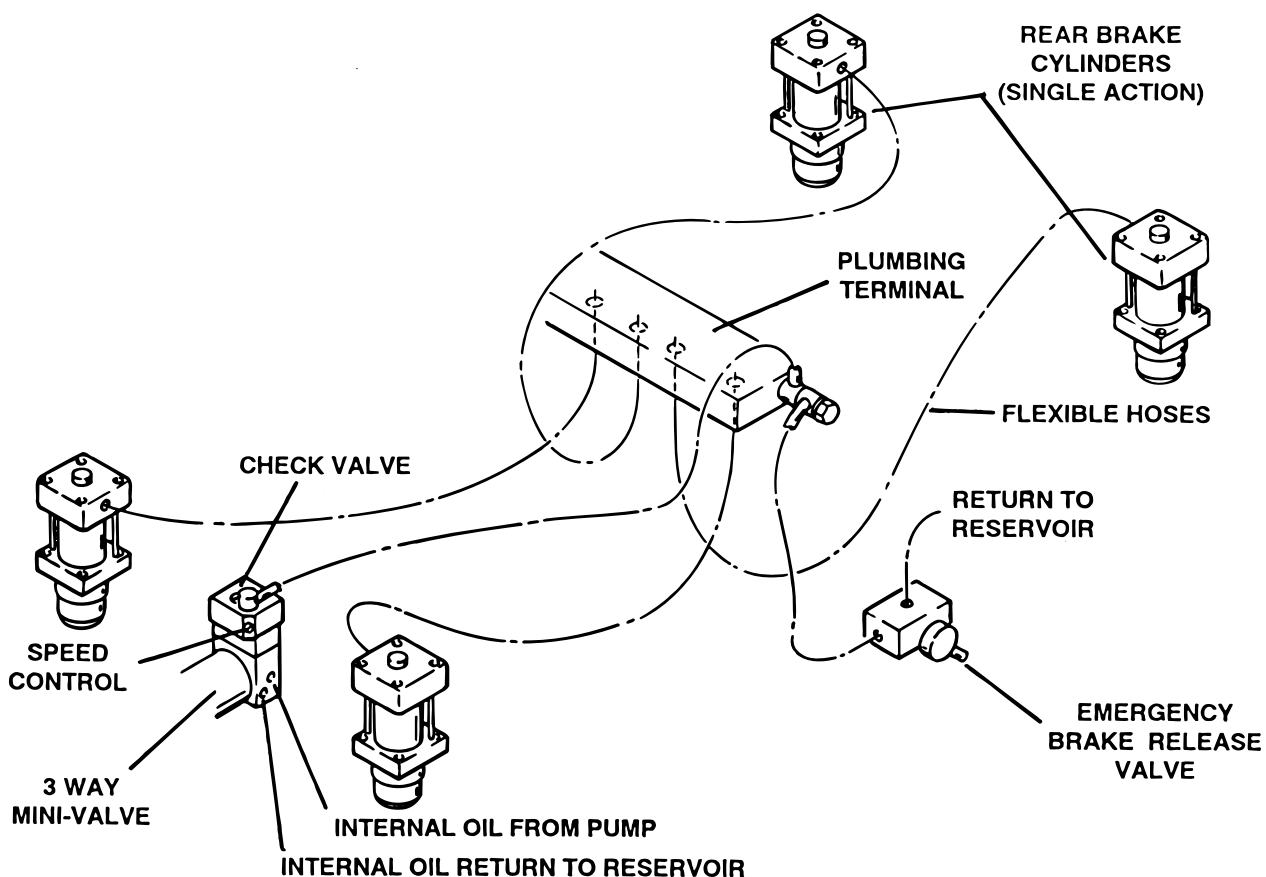


Figure 3-7. Single Action Brake System



### 3-10. Flexible Hose Identification and Placement

The following figures will show the correct placement of the flexible hydraulic hoses used in the table and their respective number codes.

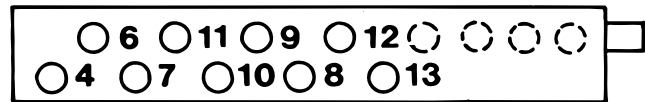


Figure 3-8. Main Plumbing Terminal

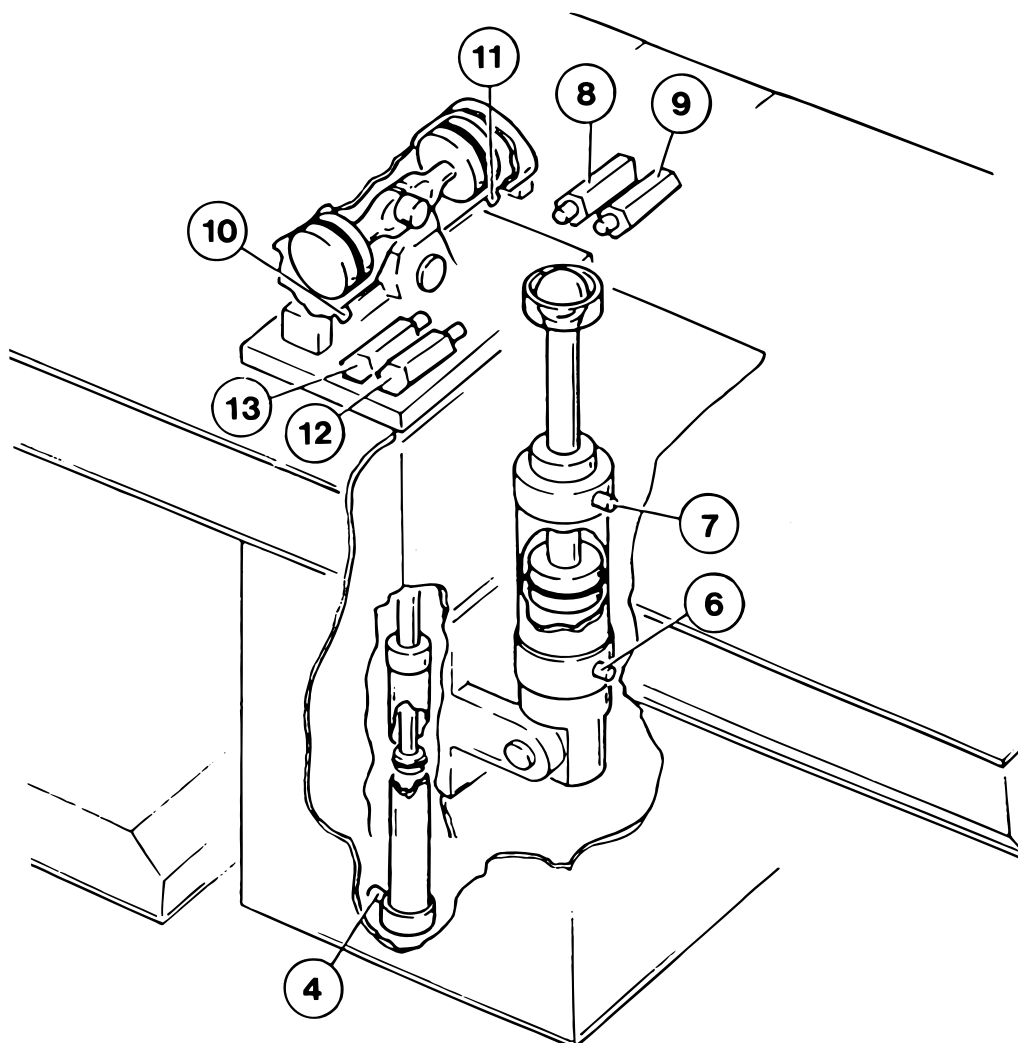


Figure 3-9. Cylinder and Plumbing Terminals

## SECTION IV ELECTRICAL SYSTEM

### 4-1. General

The complete electrical system (with the exception of the hand-held pendant control and the return circuit micro-switches) is contained within the base of the table. The pump motor and the hydraulic valves are controlled electrically with the pendant control.

The electrically operated functions are as follows:

- ELEVATION - Up and Down
- TRENDELENBURG - Head up and down
- LATERAL TILT - Right and left
- KIDNEY LIFT - Up and down
- SLIDE FUNCTION
- RETURN - Trendelenburg and lateral tilt
- UNLOCK - Brake release

The power requirements are 120 VAC, 5 amp, 60 HZ, protected by internal fuses. The main power on-off switch is an enclosed DPST type and the power cord is a three-wire, fifteen foot long, UL listed cord with a three-prong hospital grade plug.

### 4-2. Components

Refer to figures 5-1 & 6-1. for the relationship of the electrical components.

**a.** Wires, Connectors, Switches, Fuse - These provide the path for the various electrical circuits.

**b.** Relay Box - Contains the step down transformer, full wave rectifier, and relay switches. The relay switches are activated by the pendant control and in turn energize the solenoid.

**c.** Hand-Held Pendant Control - Closes micro-switches to activate relay box. Operates on 6.3 VDC.

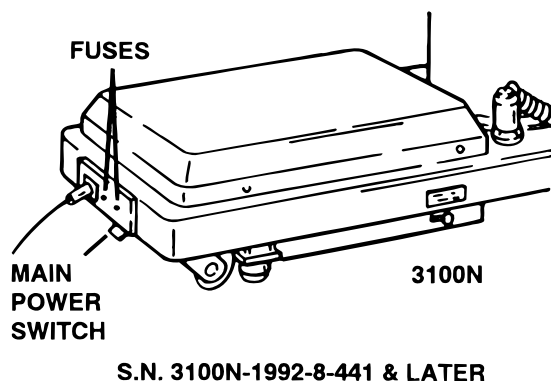
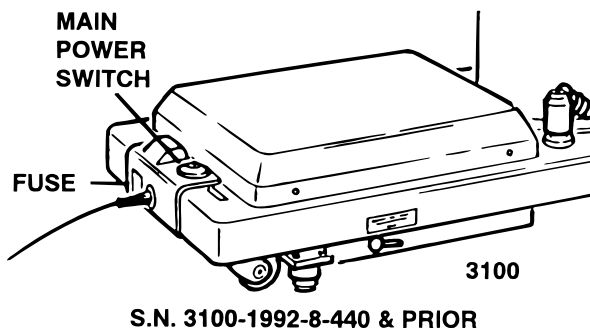
**d.** Solenoids - These electrically open and close the hydraulic ports of the mini-valve to direct the fluid to the correct cylinders. They operate on 120 VAC.

**e.** Motor/Pump Assembly - 120 VAC, 60 HZ, 200 Watt capacitor induction motor.

### 4-3. Model Coverage

Section V covers the Electrical System Troubleshooting for the Early Model base design and Section VI covers the Electrical System Troubleshooting for the "N" Series base design.

The two models can be easily identified by the position of the main power switch. The power switch is located on the top of the base on the early models and on the front of the base for the "N" series models. See figure 4-1.



### 4-1. Model Identification

## SECTION V ELECTRICAL SYSTEM TROUBLESHOOTING

### 5-1. Troubleshooting Notes

The basic operation of each component will be defined along with a drawing and explanation on how to check it out.

#### NOTE

This section covers the electrical system for the early base design tables with serial number 3100-1992-8-440 & prior. See section VI for the "N" series base design, serial number 3100N-1992-8-441 & later.

Certain defective components could cause the entire table to stop functioning or only one control function to stop, depending upon what part of the component failed. Other defective components would only cause one control function to stop.

These defective components could affect all control functions.

- a. Motor/Pump Assembly (starting capacitor)
- b. Main Switch Circuit and Wiring

These defective components could affect all control functions or only one control function:

- a. Relay Box
- b. Pendant Control

A defective Solenoid would only affect one control function.

When troubleshooting an electrical circuit, start at the problem and work back to the power source.

### 5-2. Main Switch

The main power supply, 120 VAC, 60 HZ, comes in through the power cord and through the main switch. The main switch opens both lines when in the "OFF" position. An 8 amp fuse is used in one line to protect the complete electrical system and it is located next to the main switch.

#### a. Main Switch Test

The following test will determine if line voltage is applied to connector B', which in turn would power the table.

1. Plug the power cord into the 120VAC supply (wall receptacle) and turn ON main switch.
2. Disconnect connectors B and B'. See figure 5-2. Leave all other connectors connected.

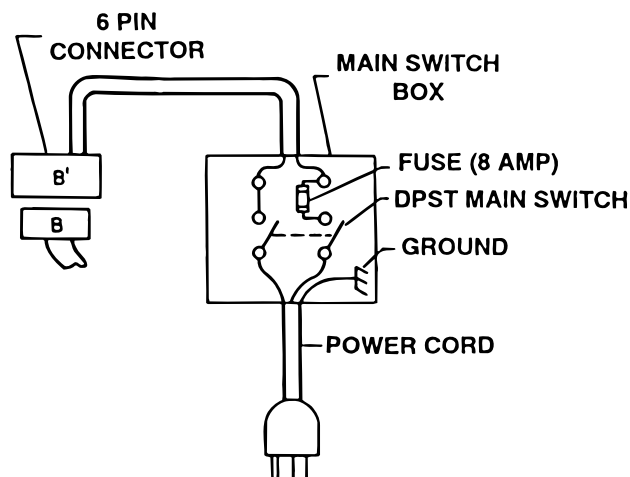


Figure 5-2. Main Switch Box and Fuse

#### CAUTION

Line voltage (120 VAC) will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

3. Use an AC voltmeter capable of measuring 120 VAC and measure the voltage between pins 1 and 3 (black and white wires) located in connector B'. See figure 5-3. You should receive line voltage 120 VAC.

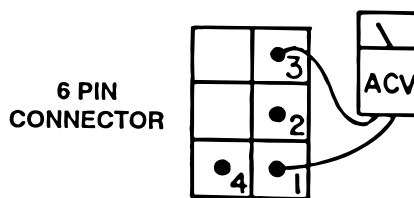


Figure 5-3. Back View Connector B'

#### CONNECTOR B' COLOR CODE

- Pin 1 -White
- Pin 2 - Blue
- Pin 3 - Black
- Pin 4 - Red

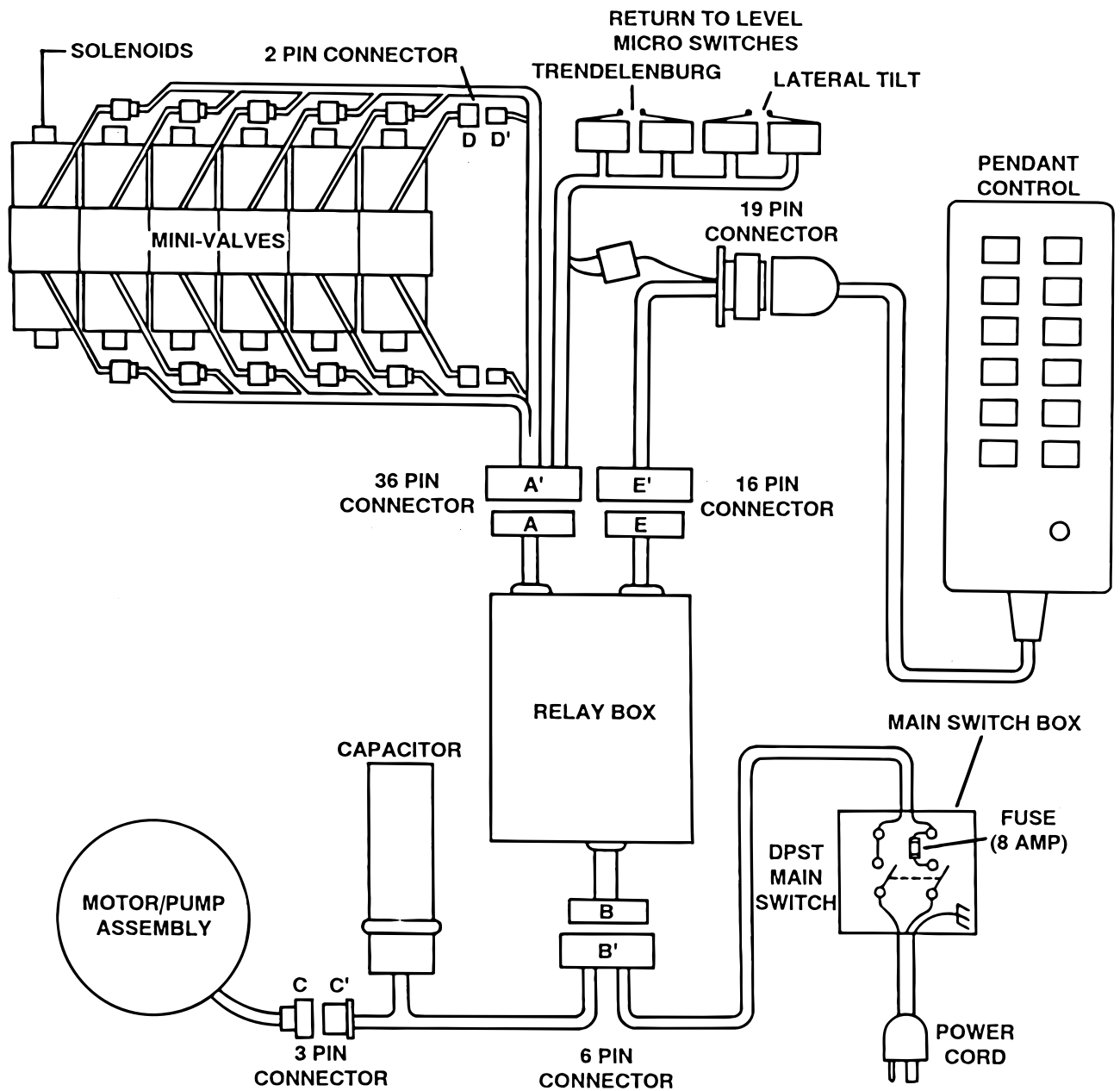


Figure 5-1. Electrical Circuit Block Diagram

## b. Test Results

If you do not receive the correct voltage measurement, the problem would have to be in the wires, main switch, fuse, or power cord. If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area.

### 5-3. Relay Box

The 120 volt power supply is directly connected to the relay contacts. When these contacts are closed, 120 volts is supplied to the solenoids which are mounted on the hydraulic mini-valves. One relay is used to supply 120V to the pump/motor and is always activated no matter what control function is selected. The brake locking circuit relay is also activated when any control function other than UNLOCK is selected.

Also, inside the relay box is a step-down transformer and full-wave rectifier which decreases the line voltage to 6.3 volts. This low voltage potential controls the relays by the use of the hand-held pendant control buttons. Basically the relays enable a 6.3 voltage potential to control the 120 volt circuit.

#### a. Relay Box Test

The following tests will determine if the relay box is functioning correctly.

#### b. Step# 1 -Checking Connector B

1. Plug the power cord into the 120 VAC supply (wall receptacle). Leave the main switch in the "OFF" position.

2. Disconnect B and B'. See figure 5-4. Leave all other connectors connected.

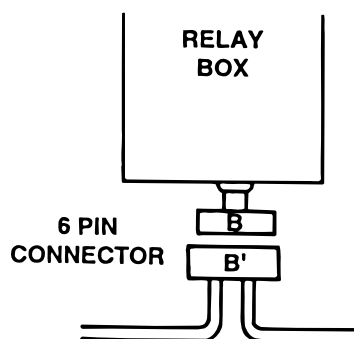


Figure 5-4.

3. Use an ohmmeter R x 1 scale to measure the following connector pins in connector B. See figure 5-5.

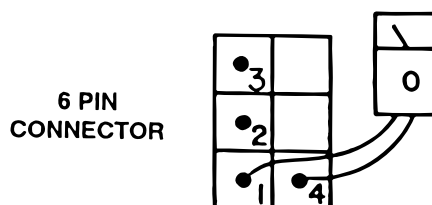


Figure 5-5. Back View Connector B

#### CONNECTOR B COLOR CODE

Pin 1 Yellow  
Pin 2 Blue  
Pin 3 Blue  
Pin 4 Red

+ TEST LEAD	- TEST LEAD	METER READING
1	2	APPROX. 200-300 OHMS
1	3	APPROX. 200-300 OHMS
1	4	0 OHMS
2	3	00 INFINITY

#### c. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.

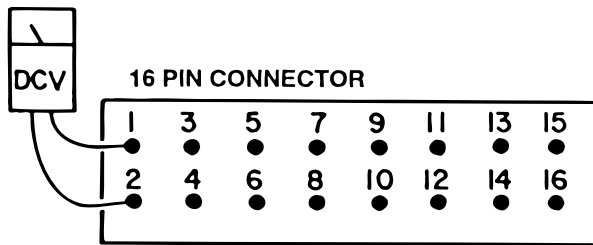
#### d. Step #2 - Checking Low Voltage (Connector E)

This test checks the low voltage applied to the pendant control buttons.

1. The power cord should be plugged into the wall receptacle and main switch turned ON.

2. Disconnect connector E and E'. See figure 4-1. All other connectors should be connected.

3. Use a DC voltage meter 10V scale, or equivalent, and measure the following connector pins located in connector E. See figure 5-6.



**Figure 5-6. Back View Connector E**

**CONNECTOR E COLOR CODE**

1 Red/White	2 White
3 Black	4 Red
5 White/Red	6 Yellow
7 Brown	8 White/Brown
9 White/Blue	10 Orange
11 White/Orange	12 White/Yellow
13 Violet/White	14 Black/White
15	16

+ TEST LEAD	- TEST LEAD	METER READINGS DC VOLTS
1	2	0V
1	3	6-10V
1	4	6-10V
1	5	6-10V
1	6	6-10V
1	7	6-10V
1	8	6-10V
1	9	6-10V
1	10	6-10V
1	11	6-10V
1	12	6-10V
1	13	6-10V
1	14	6-10V
1	15	0V
1	16	0V
2	3	6-10V

**e. Test Results:**

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.

**f. Step #3 - Checking High Voltage (Connector A)**  
This test checks the high voltage (120V) that is used to energize the solenoids.

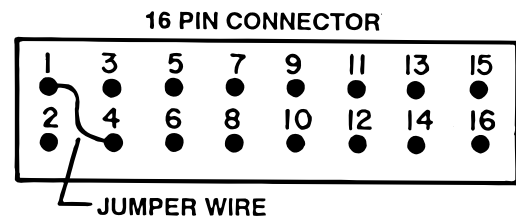
**CAUTION**

120 VAC will be measured in this test.  
Do not touch uninsulated connector pins or meter test leads.

1. The power cord should be plugged into the wall receptacle and main switch turned ON.

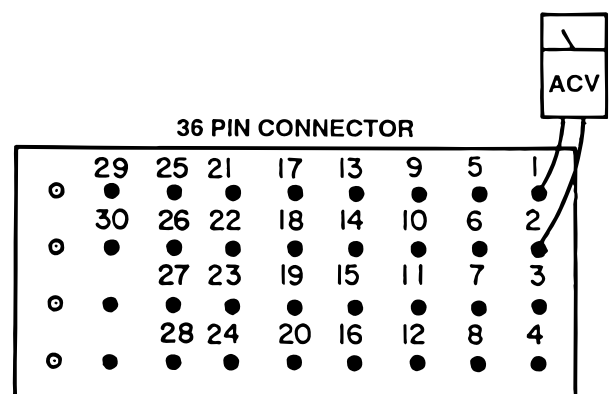
2. Disconnect connectors A and A', E and E', and the motor connector C and C'. All other connectors should be connected.

3. A jumper wire must be used to electrically close the relay contacts in order to make this test. The jumper wire will be used to connect pins 1 through 16 in the 16-pin connector E. See figure 5-7. These pins are low voltage (6.3V) and there is no danger of electrical shock.



**Figure 5-7. Back View Connector E**

4. Use an AC voltmeter capable of measuring 120 VAC and measure the voltage between the indicated connector pins located in Connector A. See figure 5-8.



**Figure 5-8. Back View Connector A**

## CONNECTOR A COLOR CODE

1 Red	15 White/Orange
2 Blue	16 Blue
3 White/Red	17 White/Yellow
4 Blue	18 Blue
5 Yellow	19 Violet/White
6 Blue	20 Blue
7 Brown	21 White/Black
8 Blue	22 Blue
9 White/Brown	23 Black/White
10 Blue	24 Blue
11 White/Blue	25 Red/White
12 Blue	26 Blue/White
13 Orange	27 Green/White
14 Blue	28 Brown/White

### IMPORTANT

Connector A is High Voltage 120 VAC.  
Connector E is Low Voltage 6.3 VDC.

CONNECTOR A		CONNECTOR E	
+ TEST LEAD	- TEST LEAD	JUMPER WIRE	METER READING
1	2	1 - 4	120V
3	4	1 - 5	120V
5	6	1 - 6	120V
7	8	1 - 7	120V
9	10	1 - 8	120V
11	12	1 - 9	120V
13	14	1 - 10	120V
15	16	1 - 11	120V
17	18	1 - 12	120V
19	20	1 - 13	120V
21	22	1 - 4	120V
23	24	1 - 14	120V

### g. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective and should be replaced.

### NOTE

Before deciding the relay box is defective, check the wires and pins in the connector blocks to make sure they are not loose or making a bad connection with their mate.

## 5-4. Pendant Control

The Pendant Control consists of 13 micro-switches (buttons). When any of the circuits are completed (by depressing a control button) the appropriate relay contacts (located in the relay box) close and

120V potential is applied to the solenoid to operate the hydraulic mini-valve. The Pendant Control has only 6.3 volts applied to it.

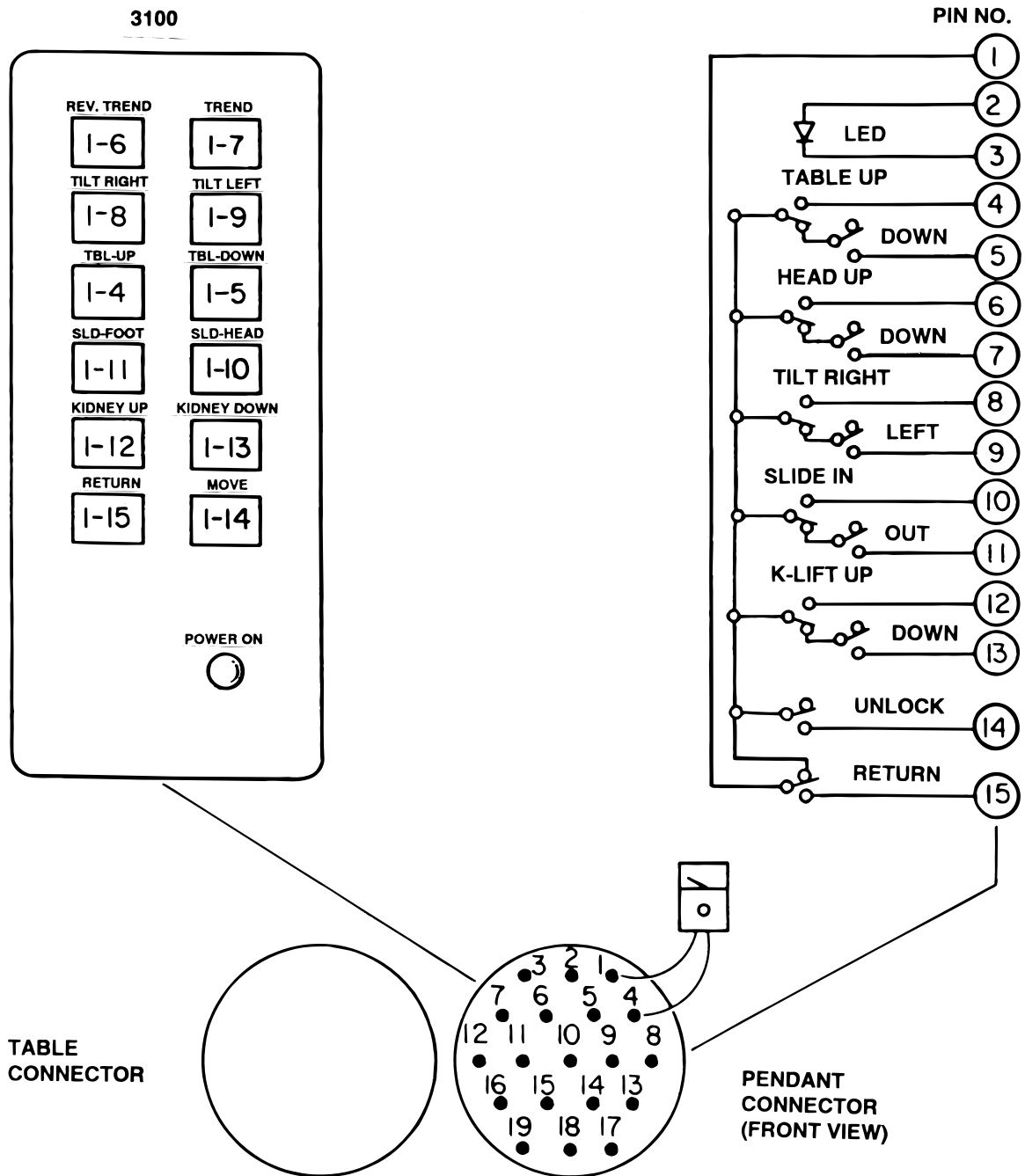


Figure 5-9. Pendant Control Test



a. Pendant Control Test

The following test will determine if the micro switches inside the Pendant Control are functioning correctly.

- 1. Unplug the 19 pin connector from the base of the table. You will be checking the cord side connector.
- 2. Use an ohmmeter R x 1 and check the continuity between pins 1 through 16. See figure 5-9.
- 3. Ohmmeter must show continuity between the pins that are indicated when the appropriate buttons are pressed.

NOTE

Pins 2 and 3 are connected to the LED (power on light on the pendant control) and cannot be checked with an ohmmeter.

b. Test Results:

If you do not receive continuity between any of the pins, either the micro-switch in the Pendant Control is defective or a wire is broken. Either of these problems can be repaired easily.

If you receive correct readings with the meter, there is nothing wrong with the Pendant Control.

c. Wiring Harness Test

The following test checks the wires leading from the relay box connector to the 19 pin connector table socket. These wires apply low voltage to the pendant control buttons. This test is similar to the test performed on the connectors explained in the relay box test.

- 1. The power cord should be plugged into the wall socket and the main switch turned ON.
- 2. Disconnect the 19 pin pendant control connector. All other connectors should be connected.
- 3. Use a DC voltmeter 10V scale and measure the following pins located in the 19 pin table socket connector. See figure 5-10.

+ TEST LEAD	- TEST LEAD	METER READINGS DC VOLTS
1	2	0V
1	3	6-10V
1	4	6-10V
1	5	6-10V
1	6	6-10V
1	7	6-10V
1	8	6-10V
1	9	6-10V
1	10	6-10V
1	11	6-10V
1	12	6-10V
1	13	6-10V
1	14	6-10V
1	16	6-10V
2	3	6-10V

Pin 16 in table socket connector will have no voltage potential unless 1 of the 4 return-to-level micro-switches are activated, i.e. trendelenburg or tilt.

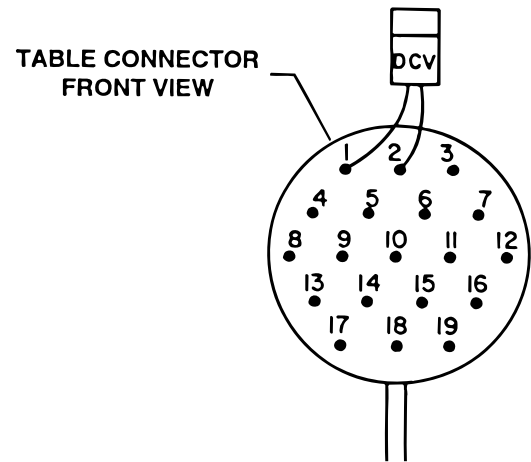


Figure 5-10. Front View Table Connector

d. Test Results:

If you do not receive the correct voltage reading, the wiring or connector pins are faulty. If the correct readings are obtained, this part of the circuit is okay.

5-5. Solenoids

The solenoids are energized by 120 volt potential that is controlled by the relays located inside the relay box.

The solenoid windings are protected from excessive heat with an internal thermal fuse that will open after approximately seven (7) minutes of continuous operation. The solenoid must be replaced if the internal thermal fuse has been blown. The solenoids are mounted directly on either side of the hydraulic mini-valves and push the spool valve in one direction or the other depending upon which solenoid is activated.

#### a. Solenoid Test

The following tests will check the voltage applied to the solenoids and the resistance of the solenoid coil.

#### NOTE

If a solenoid does not function when the pendant control button is pushed, the problem could be the pendant control, the relay box, or the solenoid.

#### NOTE

Each solenoid is controlled with 120V source coming from the relay box. This source can easily be checked by measuring the voltage at the 2 pin connector in question.

#### CAUTION

Line voltage will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

#### b. Step #1

1. Plug the table cord into the wall receptacle and turn main switch ON.

2. Disconnect the 2 pin connector from the solenoid in question, connector D' shown for example in Figure 5-11.

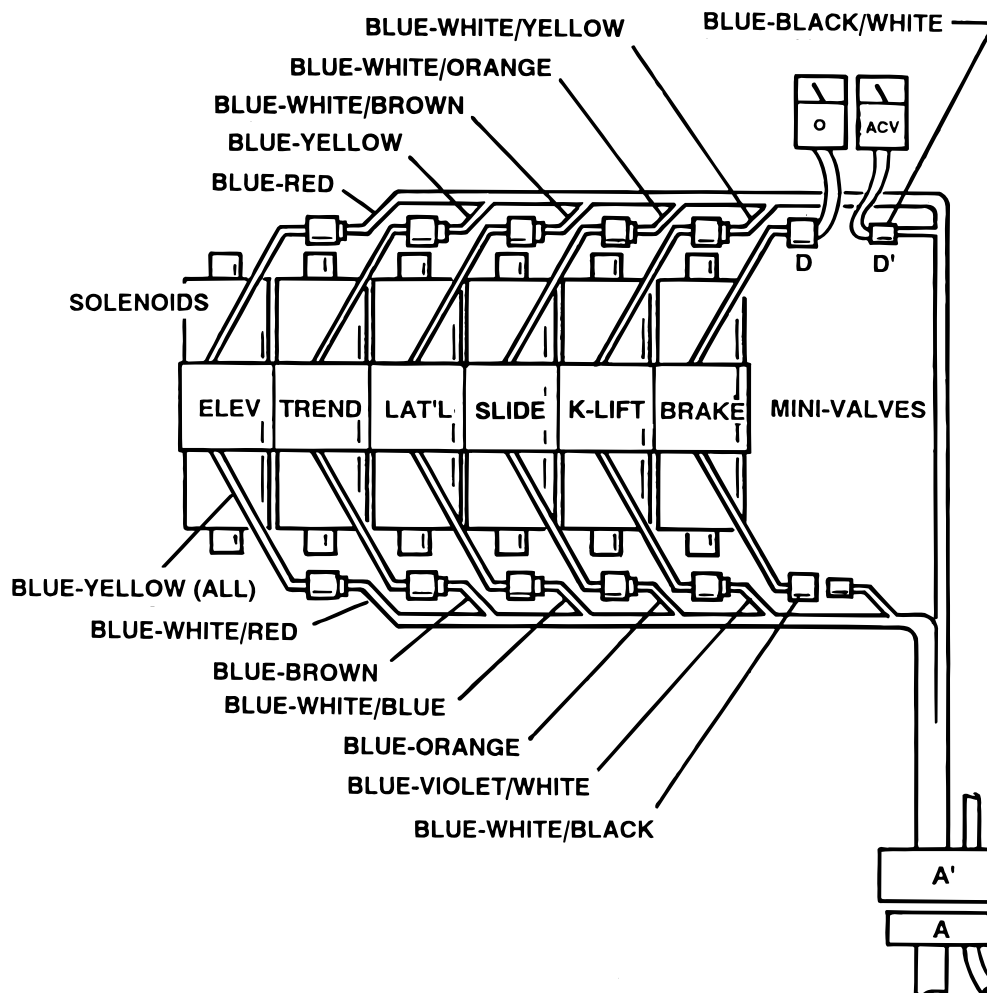


Figure 5-11. Solenoid Test

3. Use a voltmeter capable of measuring 120 VAC and measure the voltage across the 2 pin connector. Polarity of meter leads is not important.

#### **NOTE**

The appropriate pendant control button must be pushed during this test. The motor will run when this test is performed, and the brake locking solenoid will be activated by any function other than UNLOCK.

#### **c. Test Results:**

If you do not receive the correct voltage, the problem could be in the wires leading down to connector A'. The problem could also be in the relay box or the Pendant Control (refer to that section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem is more than likely the solenoid.

#### **d. Step #2**

The solenoid can be checked out using an ohmmeter R x 1 scale.

1. Measure the resistance between the two pin connector in question, connector D shown for example in Figure 5-11. Connector must be disconnected. Polarity of meter leads is not important.

2. The meter should read approximately 80-90 ohms at room temperature (58 ohms for tables S.N. 1997-4 & L).

3. Measure the resistance between either pin and ground.

4. Meter should read infinity.

#### **e. Test Results:**

If the solenoid does not check out with the meter, it is more than likely defective and must be replaced.

#### **NOTE**

Whenever there are several components of the same type, a defective unit can also be detected by substituting a known good unit or wire connector. In some cases this may be faster than using a multi-meter.

### **5-6. Motor/Pump Assembly**

The electric motor is a capacitor start type with a rating of 120 VAC, 200 watts. The field windings are protected with a thermal protector that will open the winding circuit if the motor is run continuously for approximately 10 minutes. This protector will take about 10 minutes to automatically reset. The oil pump unit is attached to the bottom of the motor and is a gear type displacement pump with a pumping capacity of .4 liter per min. The Motor/ Pump Assembly is mounted on an insulated motor plate in the base of the table. The starting capacitor is mounted along side the motor/ pump assembly

#### **a. Motor/Pump Test**

The following tests will check the voltage applied to the motor and the resistance of the motor field windings.

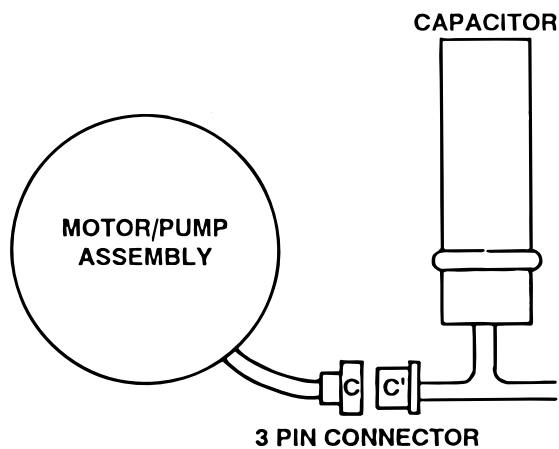
#### **CAUTION**

Line voltage will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

#### **b. Step #1**

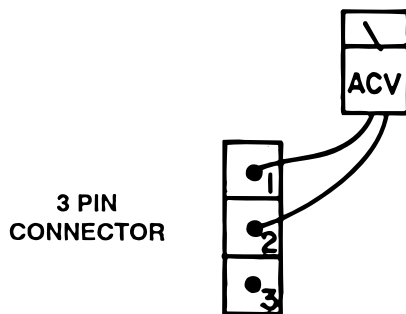
1. Plug the power cord into 120 VAC supply (wall receptacle). Turn main switch ON.

2. Disconnect the 3 pin connector C' and C at the motor. Leave all other connectors connected. See figure 5-12.



**Figure 5-12.**

3. Use a voltmeter capable of measuring 120 VAC and measure the following connector pins in connector C'. See figure 5-13.



**Figure 5-13. Back View Connector C'**

**CONNECTOR C' COLOR CODE**

- 1 - Red
- 2 - Blue
- 3 - Yellow

+ TEST LEAD	- TEST LEAD	METER READINGS AC VOLTS
1	2	120 ACV
1	3	120 ACV
2	3	0V

**c. Test Results:**

If you do not receive the correct meter readings, the problem could be in the wires, connectors, relay box, or main switch (refer to that section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem could be either the motor or the starting capacitor.

**d. Step #2**

If the starting capacitor is shorted or grounded, the motor will not run. Capacitors very seldom fail, and it requires a dielectric tester to accurately test one. However, an ohmmeter can be used to determine if the capacitor will store a low voltage charge and most of the time this is adequate.

1. Turn the main switch OFF.

2. Connectors C' and C should be disconnected.

3. Use the R x 100 scale of the ohmmeter and touch pins 2 and 3 of connector C'. See figure 5-13.

**e. Test Results:**

The meter needle should move up scale and then back down to infinity. This would indicate that the capacitor is storing an electrical charge.

**NOTE**

The capacitor may have to be discharged first (by shorting pins 2 and 3 together) before you will be able to see the ohmmeter needle swing up the scale.

**f. Step #3**

The motor windings can be statically checked for resistance using an ohmmeter.

1. Turn main power switch OFF.

2. Connectors C' and C should be disconnected.

3. Use the R x 1 scale of the ohmmeter and measure the resistance between the pins located in 3 pin connector C shown on the chart. See figure 5-14.

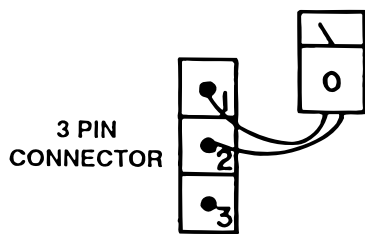


Figure 5-14. Back View Connector C

#### CONNECTOR C COLOR CODE

- 1 - Red
- 2 - White
- 3 - Yellow

+ TEST LEAD	- TEST LEAD	METER READING
1	2	APPROX. 5 OHMS
1	3	APPROX. 4 OHMS
2	3	APPROX. 8 OHMS

#### g. Test Results:

If you do not receive the correct meter readings, the motor or wiring is defective.

#### 5-7. Return-to-Level Micro-Switches.

The return-to-level feature is activated by a single button on the pendant control and automatically relevels the table top from the lateral tilt and trendelenburg positions.

The micro-switches are cam operated. They operate on 6.3 VDC, and control the function circuits (pump/motor and appropriate solenoid valves) exactly like the pendant control.

The micro-switches are wired to the relay box through the 36 pin connector A and to the pendant control 19 pin connector. See figure 5-15.

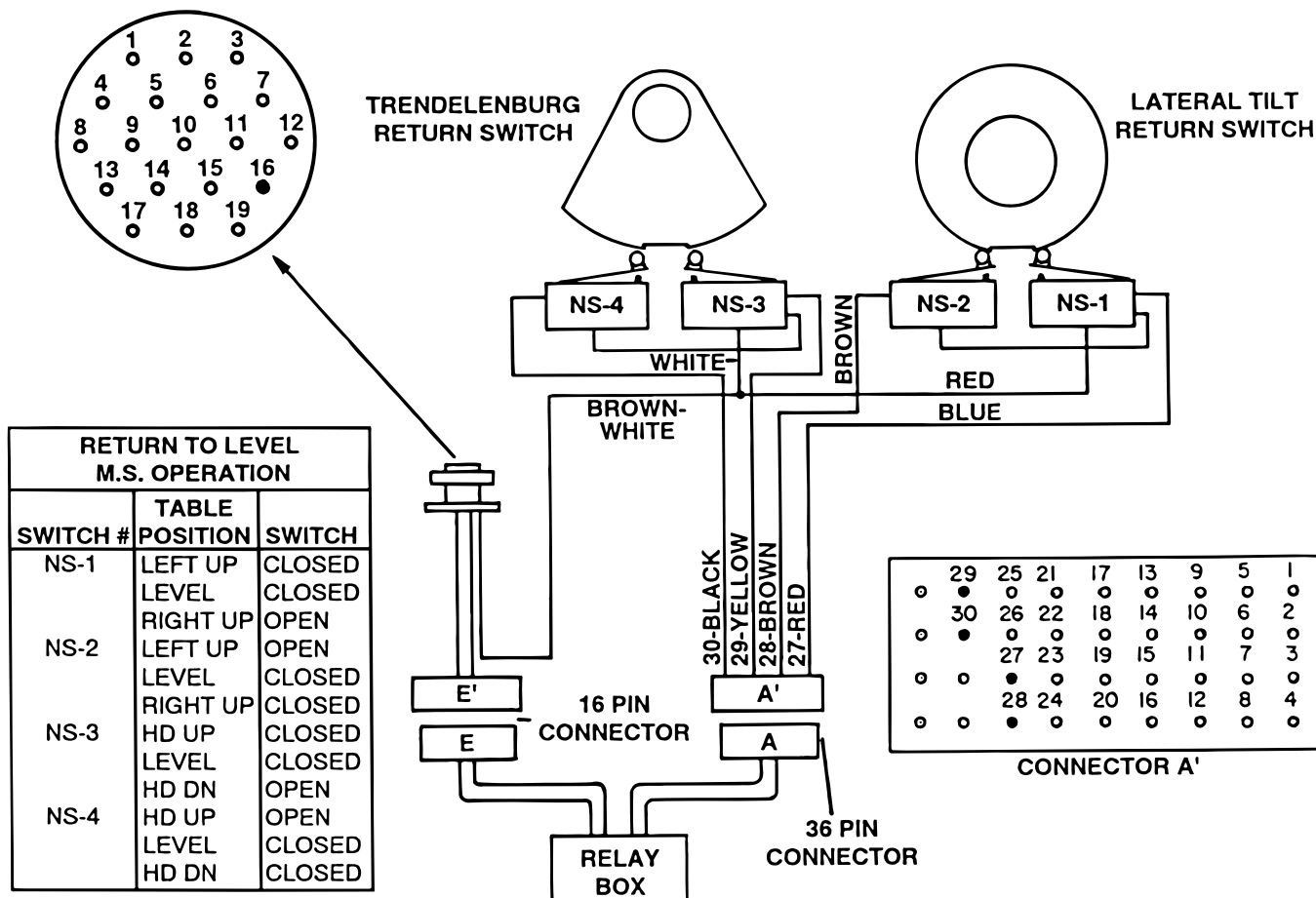
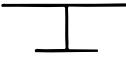


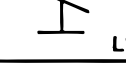



Figure 5-15. Return-to-Level Micro-Switches

### a. Switch Test.

1. Disconnect 36 pin connectors A and A', and 19 pin pendant control connector.

2. Use an ohmmeter to test the resistance between indicated pins located in the pendant control connector and connector A. Refer to figure 5-16. Polarity of test leads is not important.

WHEN TABLE IS AT	19 PIN CON-NECTOR	36 PIN CON-NECTOR	VALUE OF RESISTANCE
 LEVEL	16	27	$\infty$
	16	28	$\infty$
	16	29	$\infty$
	16	30	$\infty$
 HEAD UP	16	29	$\infty$ OHM
	16	30	0 OHM
 HEAD DOWN	16	29	0 OHM
	16	30	$\infty$
 LEFT UP	16	27	$\infty$ OHM
	16	28	0 OHM
 RIGHT UP	16	27	0 OHM
	16	28	$\infty$

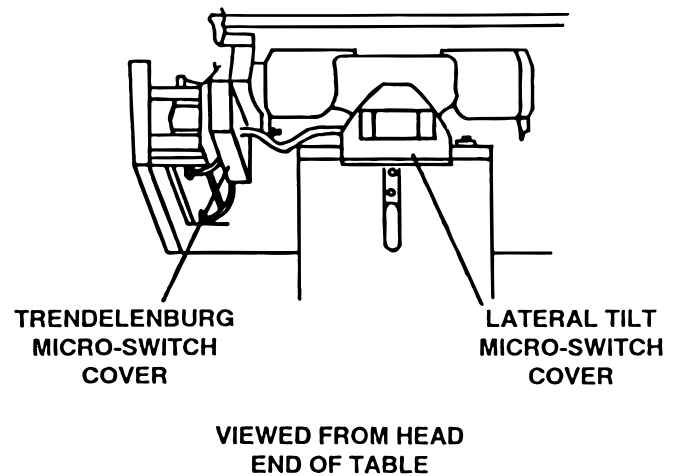
**Figure 5-16. Return-to-Level Micro-Switch Test**

### b. Switch Adjustment.

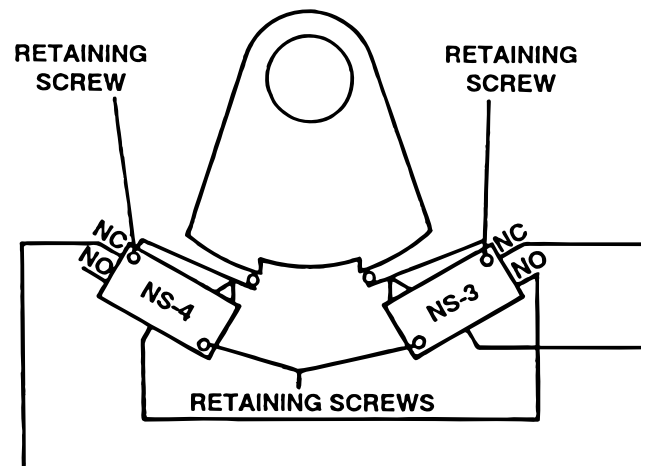
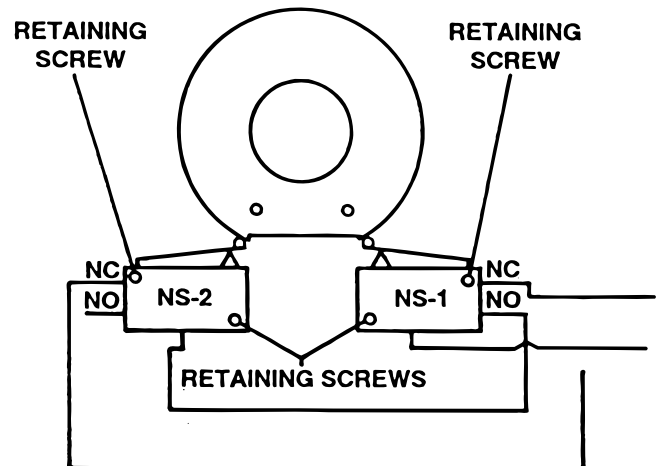
If proper readings are not obtained during test or if table does not properly return to level, use the following procedure to adjust the switches.

1. Apply table brakes and (using a level) level the table top using the TRENDLENBURG and LATERAL-TILT function buttons on the pendant control.

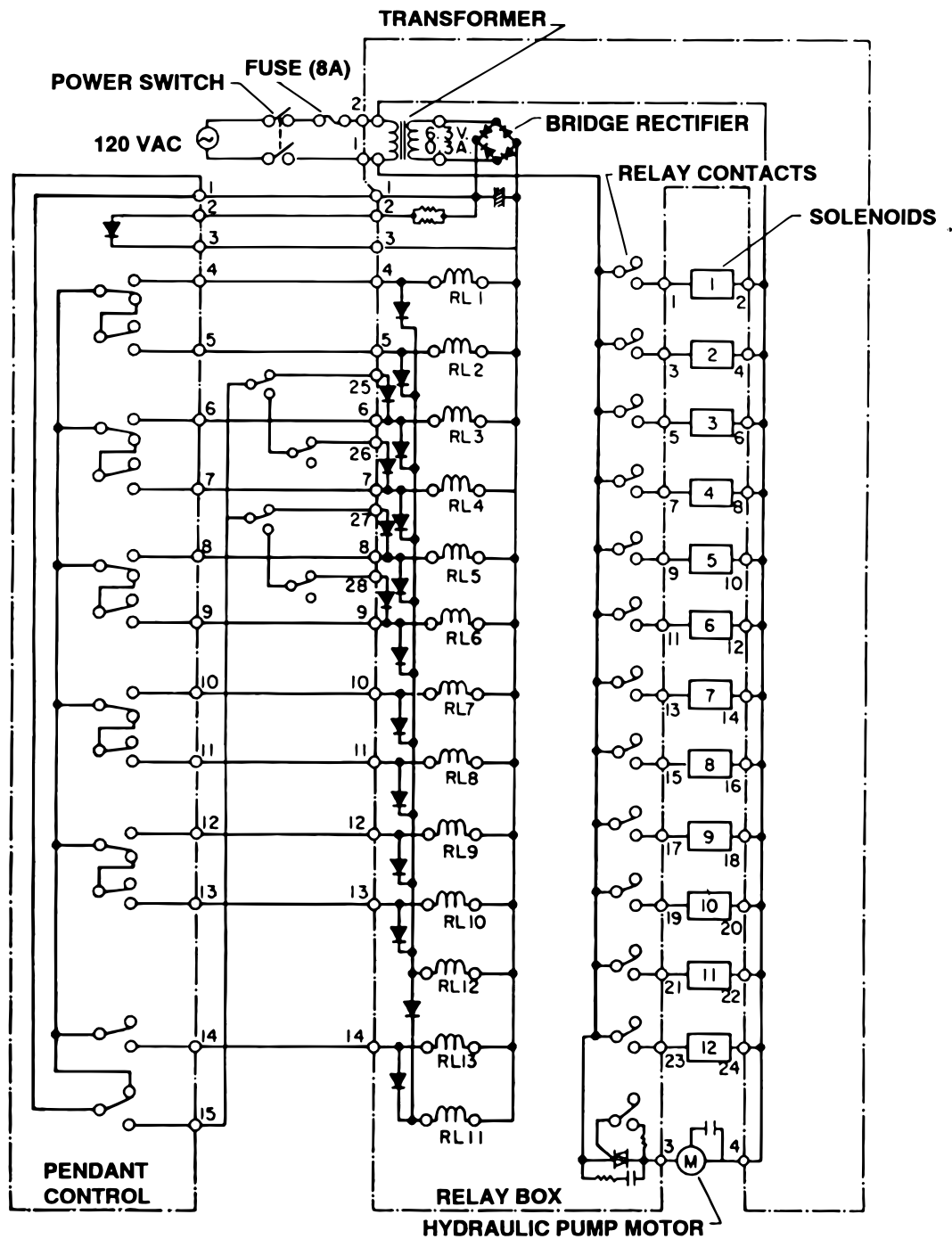
2. Remove micro-switch covers (refer to figure 5-17), carefully loosen the switch retaining screws, and adjust the switches as needed. See figure 5-18.



**Figure 5-17. Micro-Switch Covers**



**Figure 5-18. Micro-Switch Adjustment**



Wiring Diagram Model 3100 (early base design)

# 3100N

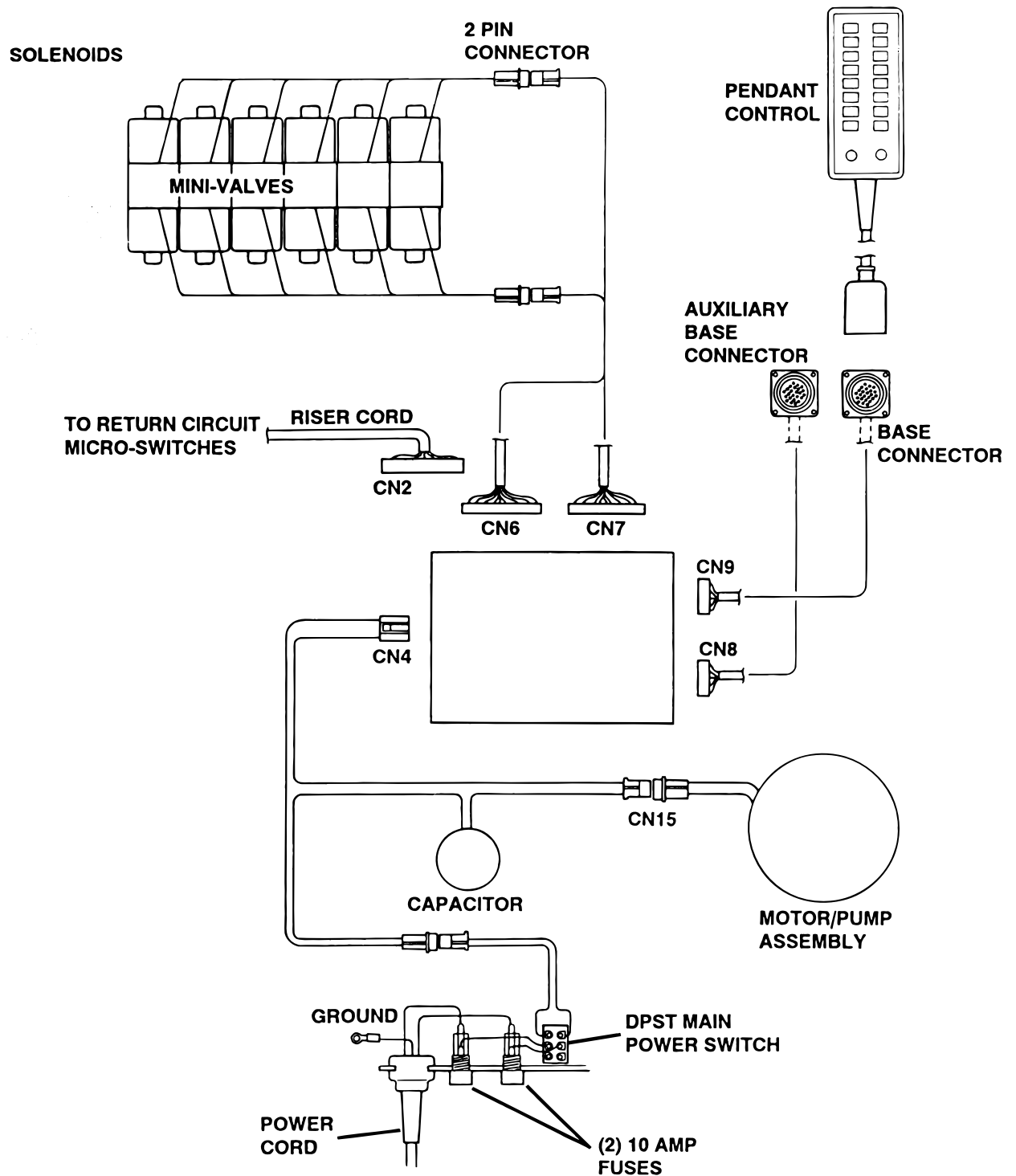


Figure 6-1. 3100N Electrical Circuit Block Diagram



## SECTION VI ELECTRICAL SYSTEM TROUBLESHOOTING

## 6-1. Troubleshooting Notes

The basic operation of each component will be defined along with a drawing and explanation on how to check it out.

**NOTE**

This section covers the electrical system for the "N" series base design tables with serial number 3100N-1992-8-441 & later. Refer to Section V for early model tables.

Certain defective components could cause the entire table to stop functioning or only one control function to stop, depending upon what part of the component failed. Other defective components would only cause one control function to stop.

These defective components could affect all control functions.

- a. Motor/Pump Assembly (starting capacitor)
- b. Main Switch Circuit and Wiring

These defective components could affect all control functions or only one control function:

- a. Relay Box
- b. Pendant Control

The component listed below would only affect one control function:

Solenoid

When troubleshooting an electrical circuit, start at the problem and work back to the power source.

## 6-2. Main Switch

The main power supply, 120VAC, 60HZ, comes in through the power cord and through the main switch. The main switch opens both lines when in the "OFF" position. Two 10 amp fuses are used to protect the complete electrical system and are located next to the main switch.

## a. Main Switch Test

The following test will determine if line voltage is applied to connector CN4, which in turn would power the table.

1. Plug the power cord into the 120VAC power supply (wall receptacle) and turn ON the main switch.

2. Disconnect connector CN4 from the relay box. See figure 6-2. Leave all other connectors connected.

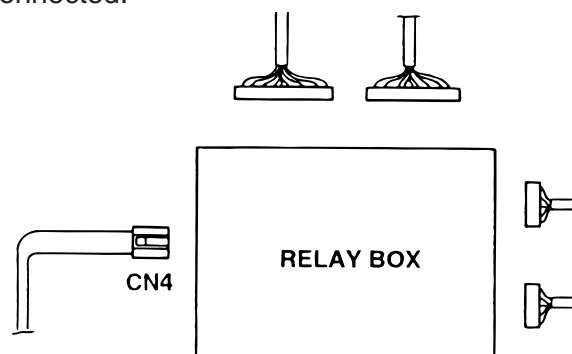


Figure 6-2. Main Power Test

**CAUTION**

Line voltage (120VAC) will be measured in this test. DO NOT touch uninsulated connector pins or meter test leads.

3. Use an AC voltmeter capable of measuring 120VAC and measure the voltage between pins 1 and 2 (black and white wires) located in connector CN4. See figure 6-3. You should receive line voltage 120VAC.

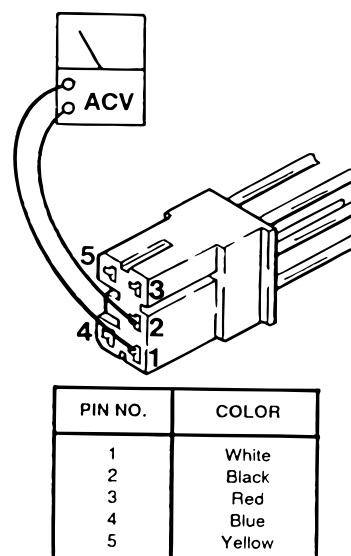


Figure 6-3. Connector CN4

## b. Test Results

If you do not receive the correct voltage measurement, the problem would have to be in the wires, main switch, fuses or power cord. If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area.

## 6-3. Pendant Control

The Pendant Control consists of 12 micro-switches (buttons). When any of the circuits are completed (by depressing a control button) the appropriate relay contacts (located in the relay box) close applying 120V potential to the appropriate solenoid to operate the mini-valve and the pump/motor. The Pendant Control has only 5-6 volts applied to it.

### a. Pendant Control Test

The following test will determine if the micro-switches inside the Pendant Control are functioning correctly.

1. Unplug the pendant control from the base of the table. You will be checking the cord side connector.

2. Use an ohmmeter R x 1 scale and check the continuity between pin 1 and pins 4 through 15. See figure 6-4.

3. Ohmmeter must show continuity between the pins that are indicated when the appropriate buttons are pressed.

### NOTE

Pins 2 and 3 are connected to the LED (power on light on the pendant control) and cannot be checked with an ohmmeter.

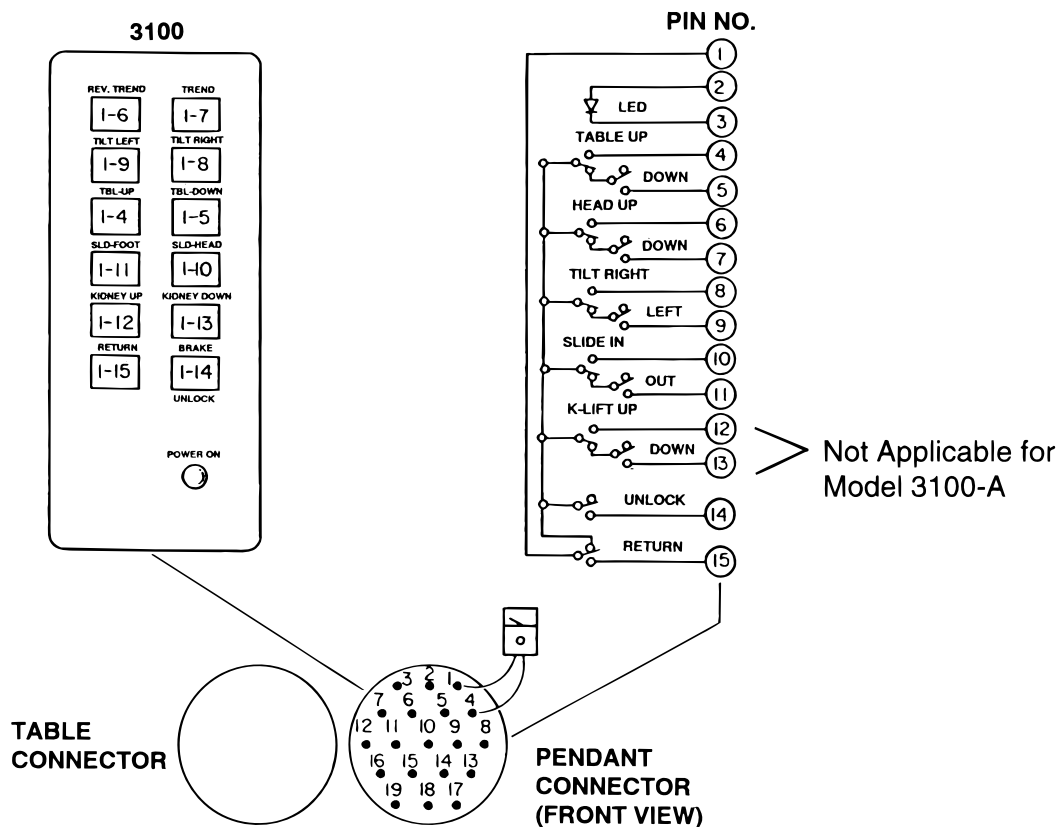


Figure 6-4. Pendant Control Test

**b. Test Results:**

If you do not receive continuity between any of the pins, either the micro-switch in the Pendant Control is defective or a wire is broken. Either of these problems can be repaired easily.

If you receive correct readings with the meter, the Pendant Control is okay.

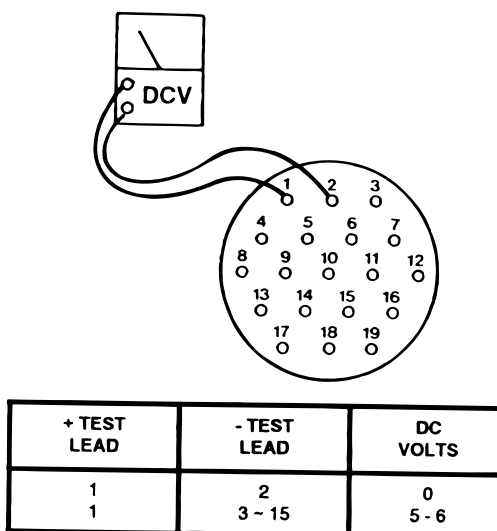
**c. Wiring Harness Test**

The following test checks the wires leading from the relay box connector CN8 to the 19 pin connector table socket. These wires apply low voltage to the pendant control buttons.

1. The power cord should be plugged into the wall socket and the main switch turned ON.
2. Disconnect the pendant control from the base connector. All other connectors should be connected.
3. Use a DC voltmeter 10V scale and measure the following pins located in the 19 pin table base connector. See figure 6-5.

**NOTE**

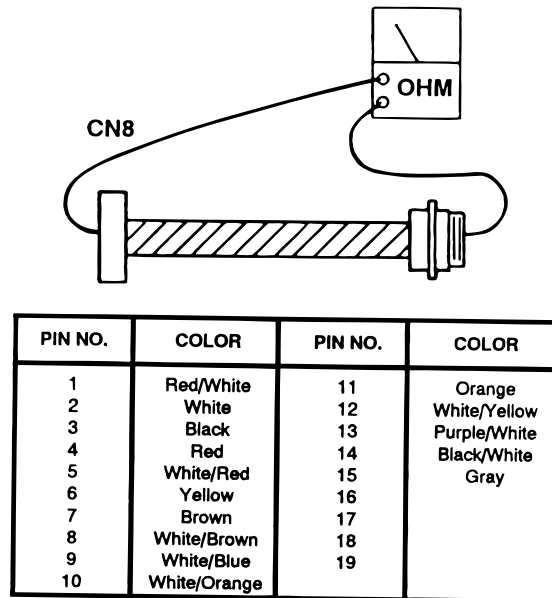
Pin 15 in table base connector will have no voltage potential unless 1 of the return-to-level micro-switches are activated, i.e. trendelenburg or tilt.



**Figure 6-5. Table Base Connector**

**d. Test Results:**

If you do not receive the correct voltage reading, the wiring or connector pins may be faulty. Disconnect connector CN8 from the relay box and using an ohmmeter, test the continuity between the corresponding pins in connectors CN8 and the table base connector. See figure 6-6. If the correct readings are obtained, this part of the circuit is okay.



**Figure 6-6. Base Connector Continuity Test**

**6-4. Relay Box**

The 120 volt power supply is directly connected to the relay contacts. When these contacts are closed, 120 volts is supplied to the solenoids which are mounted on the hydraulic mini-valves. One relay is used to supply 120V to the pump/motor and is always activated no matter what control function is selected. The brake locking circuit relay is also activated when any control function other than BRAKE UNLOCK is *initially* selected.

Also, inside the relay box is a step-down transformer and full-wave rectifier which decreases the line voltage to 5.5 volts. This low voltage potential controls the relays by the use of the hand-held pendant control buttons. Basically the relays enable a 5.5 volt potential to control the 120 volt circuit.

The following tests will determine if the relay box is functioning correctly.

#### a. Relay Box Input Connector CN4

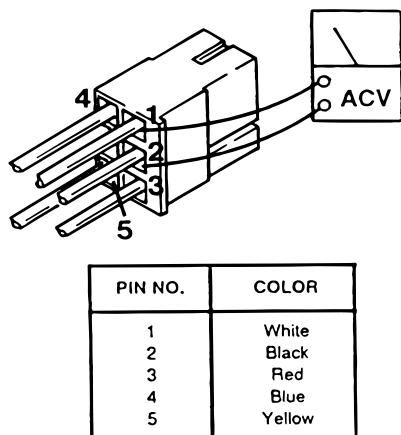
1. Plug the power cord into the 120VAC power supply (wall receptacle) and turn the main switch ON. Leave all connectors connected.

#### CAUTION

Line voltage (120VAC) will be measured in this test. DO NOT touch uninsulated connector pins or meter test leads.

2. Use an AC voltmeter capable of measuring 120 volts and measure the voltage between pins 1 (white) and 2 (black) of connector CN4 for input voltage. See figure 6-7. Meter should read line voltage 120VAC.

3. Activate any table function with the Pendant Control and using an AC voltmeter, test the voltage at pins 3 and 4 of CN4 for output to the pump. Meter should read 120VAC.



**Figure 6-7. Connector CN4**

#### b. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.

#### c. Relay Box Output Connector CN8

This test checks the low voltage applied to the pendant control buttons.

1. The power cord should be plugged into the wall receptacle and main switch turned ON.

2. Disconnect Pendant Control connector. All other connectors should be connected.

3. Using a DC voltmeter, measure the voltage between pin 1(+) and pins 4 through 15(-) of the table base connector. See figure 6-5. Meter should read 5-6 volts.

#### d. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.

#### e. Relay Box Output Connectors CN6 & CN7

This test checks the high voltage (120V) that is used to energize the solenoids.

#### CAUTION

120VAC will be measured in this test. DO NOT touch uninsulated connector pins or meter test leads.

1. The power cord should be plugged into the wall receptacle and main switch turned ON.

2. Disconnect the motor connector CN15. All other connectors should be connected. Test connectors CN6 and CN7 from the back while attached to the relay box.

3. Activate each of the Pendant Control buttons and using an AC voltmeter capable of measuring 120VAC, measure the voltage between the appropriate connector pins located in connector CN6 or CN7. See figure 6-8. Polarity of meter test leads is not important. Meter should read 120VAC.

**a. Solenoid Test**

The following tests check the voltage applied to the solenoids and the resistance of the solenoid coil.

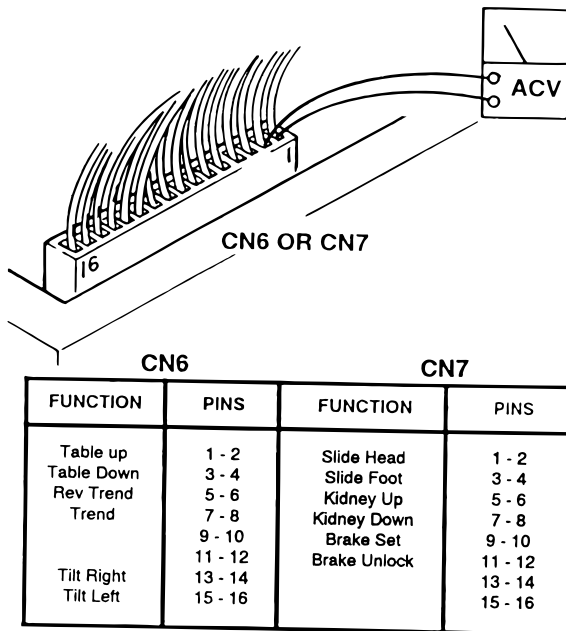
**NOTE**

•If a solenoid does not function when the pendant control button is pushed, the problem could be the pendant control, the relay box or the solenoid.

•Each solenoid is controlled with 120V source coming from the relay box. This source can easily be checked by measuring the voltage at the 2 pin connector in question.

**CAUTION**

Line voltage will be measured in this test. DO NOT touch uninsulated connector pins or meter test leads.



**Figure 6-8. Relay Box Output Connectors CN6 and CN7**

**f. Test Results:**

If you do not receive the correct meter readings, the relay box or wiring is defective and should be replaced.

**NOTE**

Before deciding the relay box is defective, check the wires and pins in the connector blocks to make sure they are not loose or making a bad connection with their mate.

**6-5. Solenoids**

The solenoids are energized by 120 volt potential that is controlled by the relays located inside the relay box.

The solenoid windings are protected from excessive heat with an internal thermal fuse that will open after approximately seven (7) minutes of continuous operation. The solenoid must be replaced if the internal thermal fuse has been opened. The solenoids are mounted directly on either side of the hydraulic mini-valves and push the spool valve in one direction or the other depending upon which solenoid is activated.

**b. Step #1**

1. Plug the table cord into the wall receptacle and turn main switch ON.

2. Disconnect the 2 pin connector from the solenoid in question. See figure 6-9.

3. Use a voltmeter capable of measuring 120VAC and measure the voltage across the 2 pin connector. Polarity of meter leads is not important.

**NOTE**

The appropriate Pendant Control button must be pushed during this test. The motor will run when this test is performed and the brake locking solenoid will be activated by any function other than UNLOCK.

**c. Test Results:**

If you do not receive the correct voltage, the problem could be in the wires leading to connectors CN6 and CN7. The problem could also be in the relay box or the Pendant Control (refer to appropriate section for troubleshooting).

## 3100N

If the correct voltage is obtained, everything is good up to that point and the problem is more than likely the solenoid.

### d. Step #2

The solenoid can be checked out using an ohmmeter R x 1 scale.

1. Measure the resistance between the two pins of the connector in question. See figure 6-9.

Connector being tested must be disconnected. Polarity of meter leads is not important.

2. The meter should read approximately 80-90 ohms at room temperature.

3. Measure the resistance between either pin and ground.

4. Meter should read infinity.

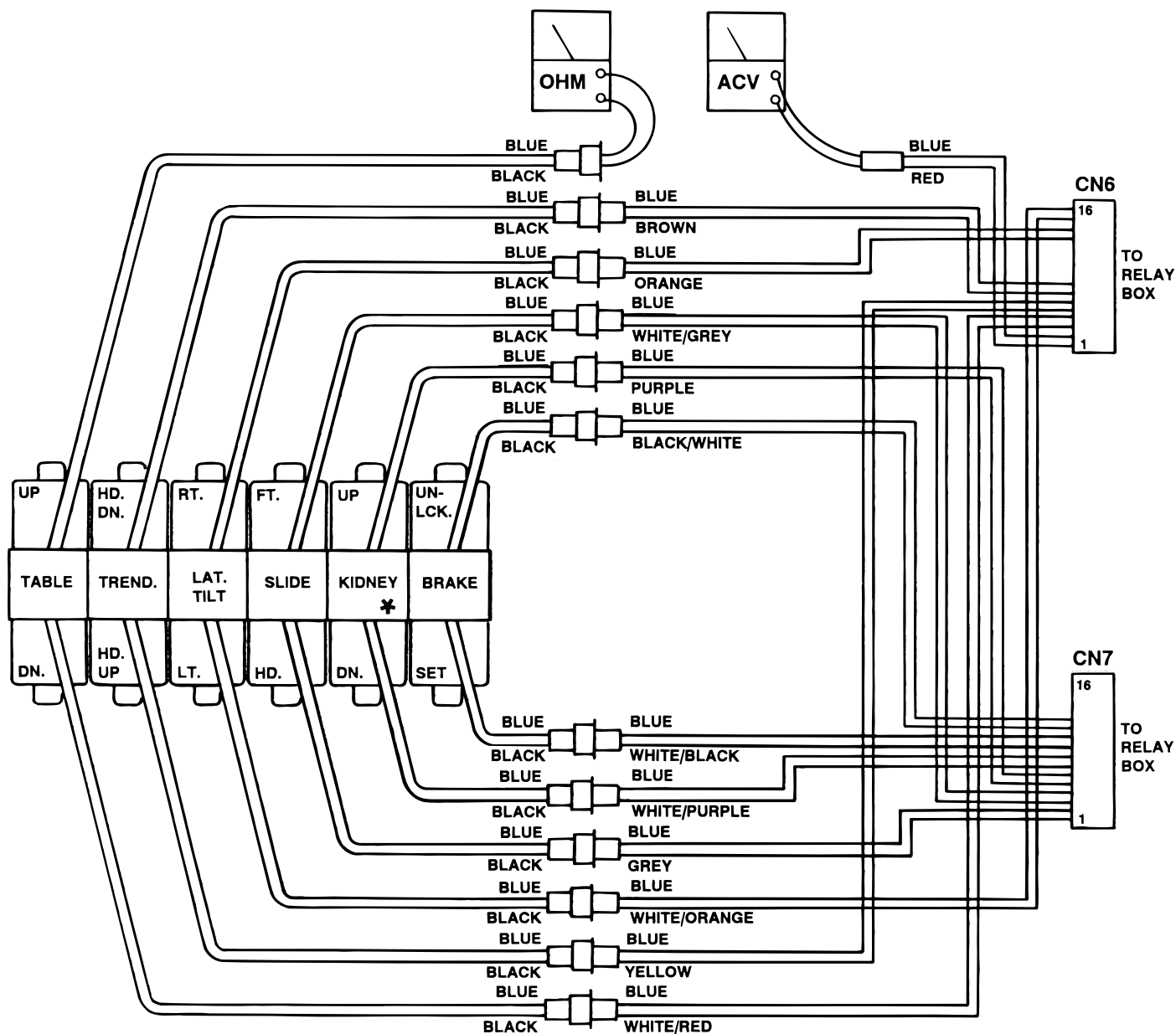


Figure 6-9 Solenoid Test



### e. Test Results:

If the solenoid does not check out with the meter, it is more than likely defective and must be replaced.

#### NOTE

Whenever there are several components of the same type, a defective unit can also be detected by substituting a known good unit or wire connector. In some cases this may be faster than using a multi-meter.

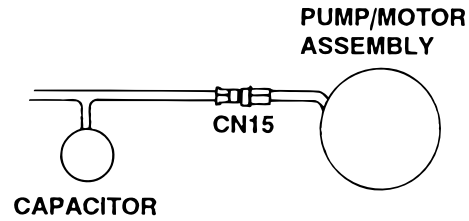


Figure 6-10.

3. Use a voltmeter capable of measuring 120VAC and measure the following connector pins in connector CN15. See figure 6-11.

### 6-6. Motor/Pump Assembly

The electric motor is a capacitor start type with a rating of 120VAC, 200 watts. The field windings are protected with a thermal protector that will open the winding circuit if the motor is run continuously for approximately 10 minutes. This protector will take about 10 minutes to automatically reset. The oil pump unit is attached to the bottom of the motor and is a gear type displacement pump with a pumping capacity of .4 liter per min. The Motor/Pump Assembly is mounted on an insulated motor plate in the base of the table. The starting capacitor is mounted along side the weights.

#### a. Motor/Pump Test

The following tests will check the voltage applied to the motor and the resistance of the motor field windings.

#### CAUTION

Line voltage will be measured in this test. DO NOT touch uninsulated connector pins or meter test leads.

#### b. Step #1

1. Plug the power cord into 120VAC power supply (wall receptacle). Turn main switch ON.

2. Disconnect the 3 pin connector CN15 at the motor. Leave all other connectors connected. See figure 6-10.

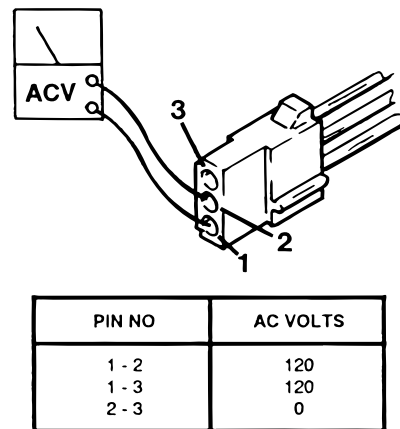


Figure 6-11. Connector CN15

### c. Test Results:

If you do not receive the correct meter readings, the problem could be in the wires, connectors, relay box or main switch (refer to appropriate section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem could be either the motor or the starting capacitor.

#### d. Step #2

If the starting capacitor is shorted or grounded, the motor will not run. Capacitors very seldom fail and it requires a dielectric tester to accurately test one. However, an ohmmeter can be used to determine if the capacitor will store a low voltage charge and most of the time this is adequate.

1. Turn the main switch OFF.
2. Connector CN15 should be disconnected.
3. Use the R x 100 scale of the ohmmeter and touch pins 2 and 3 of connector CN15. See figure 6-11.

**e. Test Results:**

The meter needle should move up scale and then back down to infinity. This would indicate that the capacitor is storing an electrical charge.

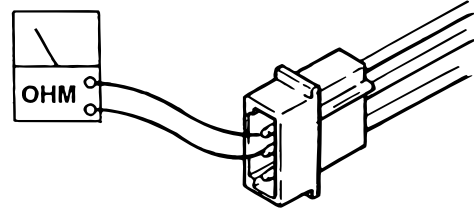
**NOTE**

The capacitor may have to be discharged first (by shorting pins 2 and 3 together) before you will be able to see the ohmmeter needle swing up the scale.

**f. Step #3**

The motor windings can be statically checked for resistance using an ohmmeter.

1. Turn main power switch OFF.
2. Connector CN15 should be disconnected.
3. Use the R x 1 scale of the ohmmeter and measure the resistance between the pins located in the pump connector CN15. See figure 6-12.



PIN NO	METER
1 - 2	Approx. 5 ohms
1 - 3	Approx. 4 ohms
2 - 3	Approx. 8 ohms

**Figure 6-12. Pump Connector CN15**

**g. Test Results:**

If you do not receive the correct meter readings, the motor or wiring is defective.

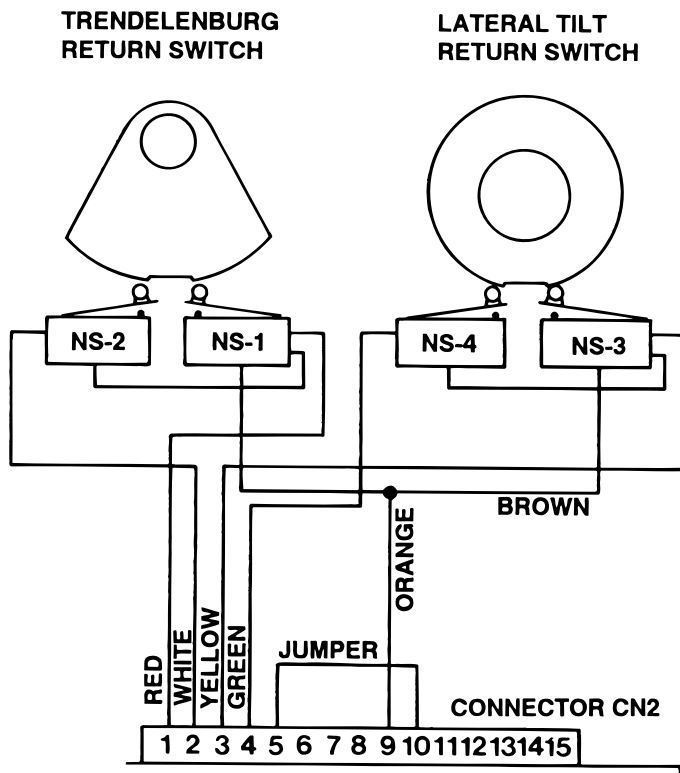


## 6-7. Return-to-Level Micro-Switches.

The return-to-level feature is activated by a single button on the pendant control and automatically relevels the table top from the lateral tilt and trendelenburg positions.

The micro-switches are cam operated. They operate on 5 to 6 VDC, and control the function circuits (pump/motor and appropriate solenoid valves) exactly like the pendant control.

The micro-switches are wired to the relay box through the 15 pin connector CN2. See figure 6-13.



### NS-1. Trendelenburg

Test at pins 1 & 9

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Head Up	Open	Infinity
Head Dn	Closed	0

When table is in Trendelenburg Position, NS-1 brings the top back to level.

### NS-2. Reverse Trendelenburg

Test at pins 2 & 9

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Head Up	Closed	0
Head Dn	Open	Infinity

When table is in Reverse Trendelenburg Position, NS-2 brings the top back to level.

### NS-3. Lateral Tilt-Left

Test at pins 3 & 9

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Tilt-Right	Open	Infinity
Tilt -Left	Closed	0

When table is in Tilt-Left Position, NS-3 brings the top back to level.

### NS-4. Lateral Tilt-Right

Test at pins 4 & 9

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Tilt-Right	Closed	0
Tilt-Left	Open	Infinity

When table is in Tilt-Right Position, NS-4 brings the top back to level.

Figure 6-13. Return-to-Level Micro-Switches

### a. Switch Test.

1. Disconnect connector CN2 from the relay box.
2. Use an ohmmeter to test the resistance between indicated pins located in connector CN-2. Refer to figure 6-14. Polarity of test leads is not important.

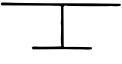




WHEN TABLE IS AT	CONNECTOR CN2		VALUE OF RESISTANCE
	PIN	PIN	
 LEVEL	9	3	INFINITY
	9	4	INFINITY
	9	1	INFINITY
	9	2	INFINITY
 HEAD UP	9	1	INFINITY
	9	2	0 OHM
 HEAD DOWN	9	1	0 OHM
	9	2	INFINITY
 TILT RIGHT	9	3	INFINITY
	9	4	0 OHM
 TILT LEFT	9	3	0 OHM
	9	4	INFINITY

Figure 6-14. Return-to-Level Micro-Switch Test

### b. Switch Adjustment.

If proper readings are not obtained during test or if table does not properly return to level, use the following procedure to adjust the switches.

1. Apply table brakes and (using a level) level the table top using the TRENDLENBURG and LATERAL-TILT function buttons on the pendant control.
2. Remove micro-switch covers (refer to figure 6-15), carefully loosen the switch retaining screws and adjust the switches as needed. See figure 6-16.

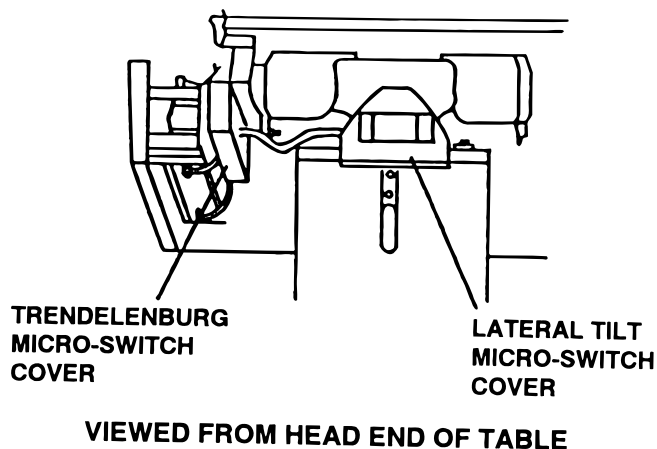


Figure 6-15. Micro-Switch Covers

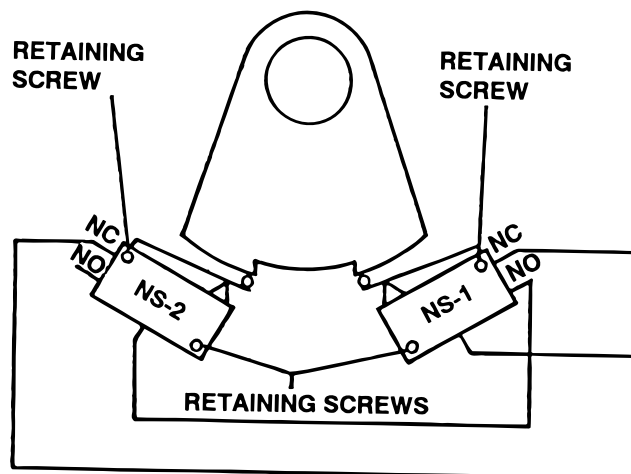
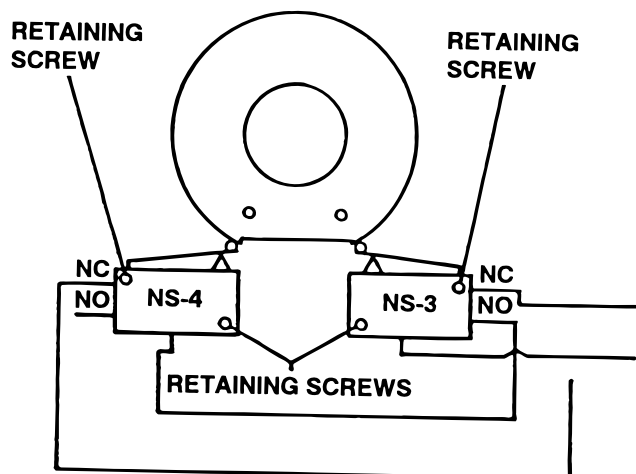
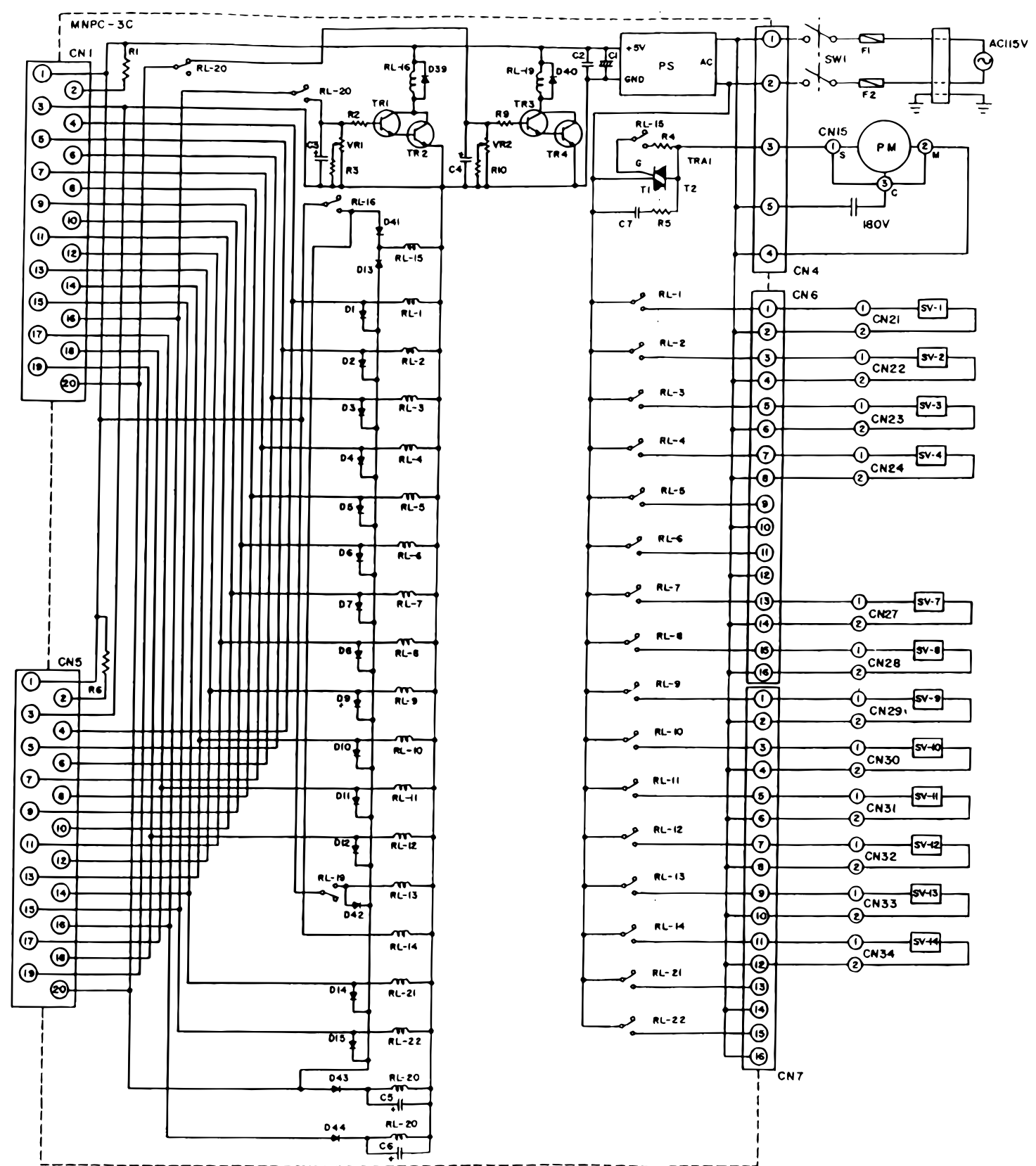
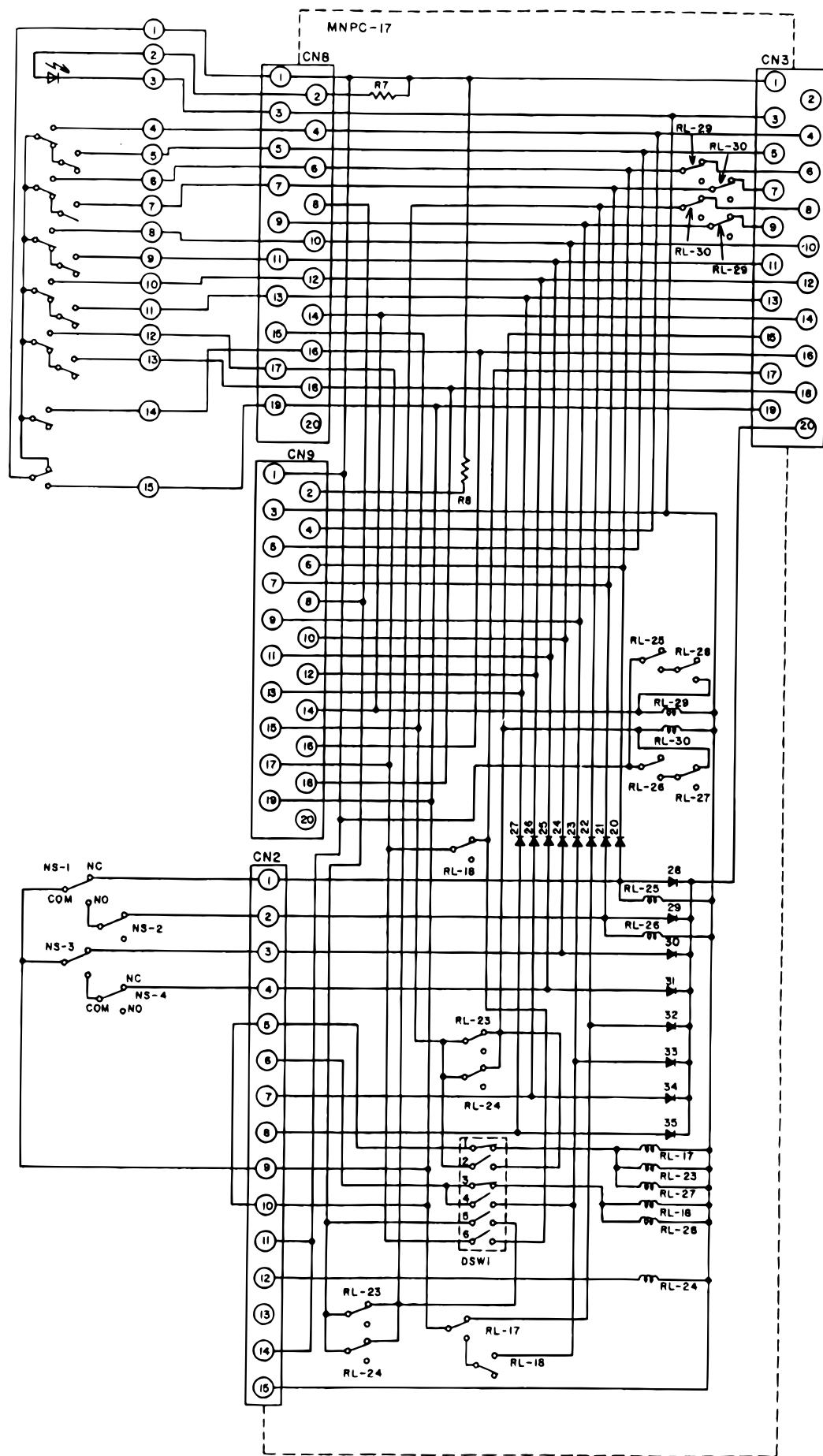


Figure 6-16. Micro-Switch Adjustment





Wiring Diagram, Model 3100N

